AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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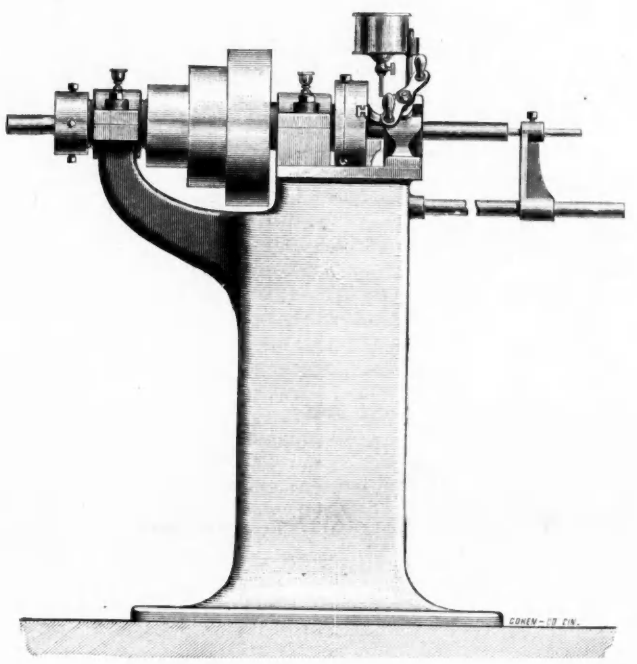
Valve Milling and Cutting-Off Machines.

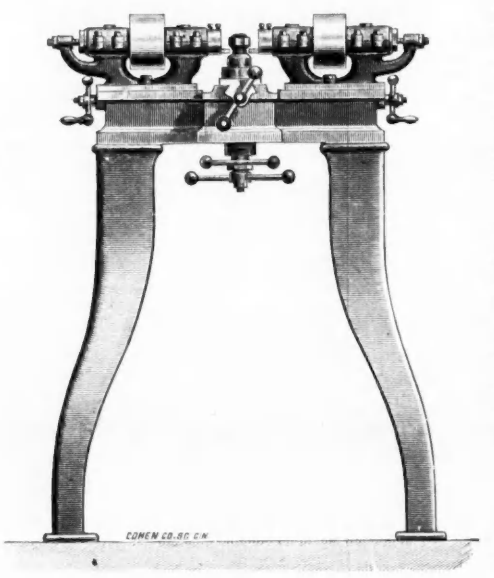
The valve milling machine, shown by cut on this page, has been designed to meet a demand of brass finishers for a cheap and simple tool for all light work, such as nuts, caps, oilers and all small work required to be done expeditiously. The machine is very compact and solid. The dividing head has an automatic movement. By moving the slide forward it revolves to next cut. When the slide is moved back it revolves the index also, thus doing away with the trouble of stopping and turning index at every cut. The device for holding nut is very simple and can be duplicated in any ordinary brass working establishment at slight cost. The boxes are made with proper facilities for taking up wear. Ends of spindles are provided with hardened steel plugs, which run against hardened steel plugs in bracket.

The cutting-off machine also illustrated herewith is of the usual type and requires no special explanation. It will cut off stock from a quarter inch to an inch and three quarters.

Both machines are made by William Barker & Co., Cincinnati, O.



VALVE MILLING MACHINE.



CUTTING OFF MACHINE.

The Relation of Steam Boilers to Triple and Quadruple Expansion Engines.

BY W. H. HOFFMAN.

Some weeks ago one of the contributors to the AMERICAN MACHINIST intimated that I did not read that valuable mechanical journal. He said "if I had read it I would know that there were steam boilers suited to factory purposes that were working in regular practice under a pressure of 250 lbs. per square inch." I suppose he referred to some of the very excellent water-tube boilers. Some of these boilers can safely carry 350 lbs. per square inch, but, as I was speaking at the time of my article on factory engines of shell boilers, I still maintain that my statements were correct.

Since my papers on the subject of compound and triple expansion engines were published, I have seen a shell fire-tube boiler, designed by a well-known engineer, that is internally fired, cylindrical in form in all details, and free from stays of any kind in its construction. This boiler is perfectly safe under a pressure of 200 lbs. per square inch, in sizes up to anything ever required in factory, locomotive or marine practice, and a 200 horse-power boiler of this type (figured on 30 lbs. of water) is tested at about 275 lbs. per square inch. The combustion is complete and the evaporative power very high, showing at least 11 lbs. So we now have a safe shell boiler suited to triple and quadruple expansion engines, and this fact established we shall soon see the factory engine in triple expansion form.

With a steam pressure of 175 lbs. to 185 lbs. above the atmosphere in the initial cylinder, and a terminal of 7 to 8 lbs. in the low-pressure cylinder, we shall have the steam engine in one of its most compact forms.

The piston speed will be from 650 feet to 850 feet per minute, and the revolutions from 90 to 250 per minute, according to capacities.

The initial cylinder of an engine of 760 to 800 horse-power, with a stroke of 39 inches, and making about 110 revolutions per minute, would be 15½ inches diameter; the intermediate cylinder, 25 inches diameter; and the low-pressure cylinder, 41 inches diameter.

These sizes, in fact, would develop over 800 horse-power, cutting off at less than one-third in the initial cylinder, and the cranks being placed at 120° will insure a shaft motion as near perfection as the laws of mechanics will permit us to reach.

This engine would weigh but very little more than a two-cylinder compound, lately described (760 horse-power), and designed for 110 lbs. of steam. According to established theory, this engine should produce a horse-power with 11 lbs. of water per hour, making due allowances for clearance, the operating of air pump, and losses in the receivers.

The boiler I have just cited will evaporate more than 11 lbs. of water with 1 lb. of anthracite coal, and we shall therefore in theory obtain a horse-power with 1 lb. of coal per hour, and in practice we shall without doubt obtain a horse-power with 13 lbs. of water per horse-power per hour, allowing for all losses.

This, then, brings us to the most durable and economical heat motor yet discovered.

As I have stated in a former paper, the packing for the piston-rod, on the initial cylinder at least, as well as all joints, should be metallic, and the steam jackets must have their drainage returned to the boilers by continuously working force-pumps, attached to the engine.

When the yacht Anthracite came from England to this country, the writer made a short trip on that vessel, in order to observe the performance of her boiler. It was a sectional one and carried with safety 375 lbs. of steam per square inch; it made steam rapidly, but was impracticable on a large scale, as it could not be cleaned easily, and the expansion and contraction caused many of its numerous joints to leak.

They used no lubricants in the initial cylinder, as they could find none to work well under a temperature due to 300 lbs. to 375 lbs. At 200 lbs., however, there was no trouble in using good cylinder oil. If pressures of 200 pounds and upwards are to be used, I should adopt the quadruple system, placing the initial cylinder behind the first intermediate, in tandem style; both pistons being on one rod, there would be three cranks, however, at 120°.

The boiler mentioned in the beginning of this article is the first one I ever saw that could be used with equal efficiency in all kinds of service, as, for instance, marine, stationary, locomotive and portable boilers.

The sectional or water-tube boiler, in any form, has not been a success as a marine boiler for anything above 100 horse-power, and it cannot be used as a locomotive or portable boiler. I wish they could be used for all powers, as their steaming capacity is very great in any of the well-known stationary forms, and they can be transported and erected with the greatest ease.

As a motor, the compound engine for factory use has made very rapid strides within the past two years, and a builder lately told me that he was ready to build engines on the triple system, as soon as a good high-pressure boiler had been adopted. The boiler above mentioned as new in design, fills the requirements. The designer, in explaining to me his methods of construction, stated that these boilers will be laid out, flanged, punched and drilled by machinery to gauges, so that they may be transported in small sections when necessary, and then erected on the plant by any intelligent boiler maker.

All details will be largely interchangeable, and by this arrangement, any part of the boiler failing from overwork or other causes, can be replaced by sending for a duplicate section which will be sure to enter the place of the one removed, without other manipulation than simply driving the rivets.

A report made at Munich in September, 1885, on the present condition of electric lighting by Dr. N. H. Schilling has been published in pamphlet form for sale. He endeavors to show that electric light companies are not making money by furnishing the light, that the light is more expensive than gas and that it has not made much progress either in Europe or America. He says:

Experiments with electric street lighting have been made on a larger and smaller scale in various places, and are still going on. Particularly in North America, they seem to have tried nearly all methods, from the little incandescent lamp to the central arc light at the top of a high mast. But electric lighting, even there, has not been adopted into regular practice.

This may be accepted as fact in Bavaria, but it is well enough known throughout this country that lighting streets by electricity is about as regular business as can be found It is a business that is making rapid progress, and there is no probability that it will not continue to increase.

The free-traders are anxious to stimulate importations. The Philadelphia *Record*, which represents them, says: "If a deficiency were created by the proposed repeal of the tobacco tax, it might be necessary to reduce duties in order to increase the revenue." Of course, the cutting down of protective duties to a "tariff for revenue only" basis would make more revenue by increasing importations. That is what free-traders want.

A little dirt can cause a large amount of trouble. When erecting a nice machine, where the parts are close-fitting, the presence of a small amount of dust will produce effects which are sometimes brought back to the mechanic as poor workmanship.

Look to the screws that hold the gib of the lathe cross-feed. These screws can work loose as well as other screws, and a dig from the tool may spoil a nice piece of work before the loose gib is discovered.

The same may apply to the spring gibs which hold the slide-rest to the lathe. Sometimes these are tightened for a heavy overhang cut, and left in that position, making the carriage run hard. Watch closely and keep the rolls well oiled.

A recent writer, Mr. Ham, on "Education of the Hand," makes this point: "In forty years the several chancelors of the English Exchequers contrived to raise about thirteen million dollars for the liquidation of the public debt. In a single year the employment of the Bessemer processes in the production of steel effected a saving of eight hundred millions." The point may be a little overdrawn, but it is true enough for all practical purposes.

Patterns for Screws.

BY F. W. BARROWS.

Fig. 36 shows a worm for use with a worm-wheel. This worm might be moulded in a horizontal position, but then the joint will always show on the casting. They are sometimes moulded perpendicularly, the moulder screwing the pattern out of the sand. When moulded in this way, the accuracy of the thread depends in a great measure upon the skill of the moulder. I think a great deal better job may be done in the way I shall describe.

Make your pattern for worm with long ends, as shown in the figure, one end being of the largest diameter of worm. If you already have the pattern, you can fit a piece over the end to make it like figure. The opposite end should be of the size desired for spindle or shaft, or for core print, if the worm is to be cast hollow. If you wish to cast on shaft, make this small end of pattern the same size as shaft. This pattern is used in forming the core, which in turn forms the casting. The core-box is made round and large enough to leave plenty of sand outside of worm.

You will see by the figure that the thread of worm is worked about one turn more than is needed for the casting. The core-box is parted through the middle for convenience in removing the core when made. The end, marked *a*, is left open, with an arm across having a hole through it, which the pattern will fit. The other end of box has a thick head, with a hole through it the same diameter as points of thread.

You will notice in the sketch that the thread of worm lies partly in this end of box. The pattern is placed in box with the right length of thread inside, and then where the thread enters head a piece is fitted, *b*, which will stop off the core, and is carried around far enough to completely fill the thread for a couple of inches.

After the core has been rammed up, which is done through the open end, the pattern is removed by screwing it out through the large end of box, the piece *b*, which we put in to stop off the thread, forming a guide for the thread and taking all strain off the sand. The small end of pattern must be long enough to reach through the box, and support pattern after the worm has been entirely screwed out of the sand.

The advantage of drawing a screw in this manner lies in the fact that there is no joint in the mould, and therefore we get a smooth, continuous thread without any chipping. This leaves the skin of the casting intact, which will, of course, make it wear longer.

If your casting is to have a hole through it, the core will stop off the mould at large end. If you wish to cast on shaft make the small end of pattern the same size as shaft, then make an annular core. This core should be made in the same box that we made the worm in. The lower end of the core-box is fastened with screws; these may be taken out and the loose head moved up to make whatever length of core thought necessary to support the shaft. Use the worm pattern by placing it in the box with the end of worm even with inside of box, then ram up the core and draw the pattern through the large end of box.

If you want the spindle at both ends of cast iron, or of the same material as worm is made of, make a piece which will be of the shape you wish, making the two ends of the same size respectively as the ends of worm pattern, or possibly the same pattern may do if you want the two ends of the same diameter. In either case put the form in same core-box that was used before, and make whatever length of core you may want.

I think you will find your casting to be pretty good. One very necessary part, which I overlooked, is that you will need a straight round pattern of the size of core-box, and long enough to make a mould that all the cores for the casting may be laid in This mould may be poured on end or horizontally as you may think best.

I have endeavored to impress in these articles on screw threads that accuracy is indispensable in laying them out.

Oftentimes a cast screw may be made to take place of a cut screw, and where a great many are to be made will, of course, be much cheaper. If I have succeeded in showing how cast screws may be made, and made nicely, then I have accomplished my object in these papers.

State Agricultural College of Michigan.

We take the following description of the new shop facilities of this institution from a recent circular. From this catalogue it appears that very liberal terms are made with students, and every effort made to put those lacking means in the way of helping themselves:

By means of a liberal appropriation of money made by the Legislature last winter, the faculty of the college has been enlarged, and a fine large building has been completed and equipped for the new course in mechanic arts. In this building there is a complete blacksmith shop and brass foundry, supplied with benches, forges, tools of all kinds and a Sturtevant pressure blower, a gift to the institution from the generous inventor and manufacturer. There is also an iron working shop, 50 by 60 feet, furnished with an engine, seven engine lathes, a planer, a shaper, a power drill, emery wheels, benches, vises, and tools and machinery necessary to a complete shop. * * * A fine turret lathe has just been completed by the students.

There is also a large wood-working shop, supplied with two lathes, a jig saw, benches, vises and ten sets of carpenter's tools. Besides these, there are offices, store-rooms, a large well-lighted drafting room, a room for blue printing, a fine large lecture room for classes in mechanics, and a mechanical laboratory, well supplied with apparatus.

From the able inaugural address of President Willets we have only room for the following, which gives some of the aims of the institution in forcible language:

Our purpose and wish is to take the young man who has an aptitude and taste for mechanical industry from the shop give him a thorough course in drawing and design, thorough instruction in all those general principles which he cannot obtain elsewhere, for the reasons heretofore stated, give him daily practical work in the shop, and then return him to the shop, with a skill competent to take his place as a journeyman and an intelligence fitting him for foremanship, with a moral purpose not above working at the bench or the forge, and yet with a capability of handling men and affairs. Such a man will as journeyman be the first to be engaged and the last to be discharged; such a man is on the high road, through the shop, to the head of his industry, a journeyman with the germ and possibilities of a master mechanic. We do not seek to make men "bosses." Our industrial foremen are a little shy of the "college-bred mechanic," for the reason, as they say, "he is apt to have the big head." But that depends upon the college at which he is bred. We grant you that the tendency of the regulation college whose purpose is a general and so-called liberal education is to breed, to use the words of another, "a sort of contempt for manual labor and the man who performs it, and to give its students very stilted notions about culture and the exalted character of the work they must do because, forsooth, they are graduates." Such a man "is not calculated to blossom out into the common sense, aggressive, enterprising young American, who is ready to do anything honorable until something better offers, and who is sure to make his way in the world." Is it possible to have a college that shall educate the scholar and yet save the artisan; that shall make the man of culture and yet preserve the farmer? We believe it is, and that the Agricultural College of Michigan is such an institution.

Cornelius Vanderbilt has made a proposition to the New York Central and Hudson River Railroad to erect a building for the use of employes of the railroads using the Grand Central Depot, in New York city, if the company will set apart land 80×40 feet near the depot. The proposition was promptly accepted. Mr. Vanderbilt wrote:

As a business proposition, I think no better use can be made of it. It has been for many years the policy of the company to encourage, at different points on its lines, efforts looking to the comfort and welfare of the men. These experiments have been very successful, and have fostered and promoted good feeling, better service, and general recognition of common interests in the work of the company. * * *

I have had plans prepared for a building, 80 feet front by 40 feet in depth, to be used for the benefit of railroad men in the service of the companies centering at the Grand Central Depot. It will be a substantial structure, with bath-rooms, gymnasium and bowling alleys in the basement; reading-rooms, library, room for games, and offices on the first floor; a large hall for general meetings and rooms for classes on the second floor; and rooms for janitor's family and sleeping-rooms for men coming in late or detained in the city over-night, in the upper story. I wish you to lay before the Board of Directors this proposition: If the company will set apart the land at the corner of Madison avenue and Forty-fifth street (40 feet on the street by 80 feet on the avenue), for the use and purposes for which such a building would be erected, I will bear all the expense of construction and of fitting and furnishing it ready for use.

Hand Grenades.

A test of the Lewis hand grenade was given one Saturday in June, at First avenue and Nineteenth street, according to the *Fireman's Herald*, which says:

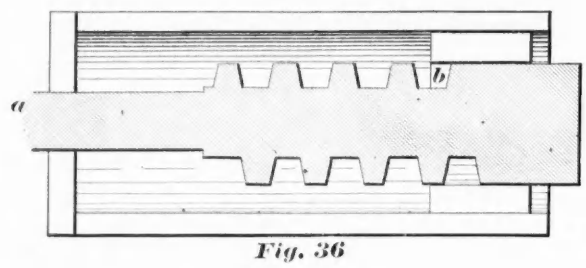


Fig. 36

PATTERN FOR WORM.

"A crowd had assembled, a man stepped forward and talked about the chemicals and announced that he would set a small house on fire and let it burn half up and then put it out. Accordingly he set the house on fire, let it burn half up, and then began throwing the grenades. He might as well have thrown so much benzine for all the good it did. It proved to be a failure. He made an excuse saying it was merely an advertisement and on Monday he would erect a house 12x20x12 and prove to the people it was not a fraud. Monday morning came and the reporter went up to the place and waited till 9 o'clock, but the Lewis hand grenade man did not put in appearance."

We hear a good deal said in these times of specialists about the value of learning and following only a particular branch of any business. There is much nonsense in such talk. A man is no worse in one thing because he knows something of another. As having some bearing on this we extract the following from an intelligent correspondent of *Engineering* on the subject of "English *vs.* American bridge work."

As explained by Mr. Shellshear, American bridgebuiders are required to provide, design, and detail drawings and strain sheets, along with their estimate, thus combining the work done in England by the civil engineer and the bridgebuilder, and consequently reducing the cost of the contract by a sum, at least, equal to the commission charged by the engineer. The result of this practice is to call out all originality, and to stimulate the "go-aheadism" with which our American cousins are credited. In American establishments, the principals—with very few exceptions—understand their business thoroughly, both in theory and practice, and in choosing their assistants, they naturally look out for those whose training has been in accord with their own. The consequence of which is, that the staff is in a highly efficient state, each member able to tackle successfully any work which comes to hand, and willing to work, and to do it late and early, well knowing that meritorious work alone is recognized, and suitably requited. In England, the bridgebuilder is called upon to tender for work, the complete design, detail drawings, and specifications of which are supplied, leaving him merely to take out the quantities, price them, and submit his estimate. He is thereby relieved of an immense amount of care and work, but at the same time the tendency is to reduce him to the level of a mere "hewer of wood and drawer of water," which in the majority of cases is his true position.

There is, in our opinion, a world of truth in the foregoing. And it all goes to show the importance of anyone knowing how to do something more than is comprised in one little line of any business.

This may be brought down—if it is down—to other things than bridgebuilding. So far from a workman being of less value to his employer because he has not given attention to one machine in exclusion to all others, we believe he is all the better for knowing a good deal about machines in general. The idea that machine tenders are as valuable as machinists will eventually be thoroughly exploded.

Apprenticeship in Delaware.

As of interest in the line of general discussion of the apprenticeship question, we copy the following from the form of agreement for minors entering the service of the Betts Machine Company, Wilmington, Del. It will be seen that this agreement implies apprenticeship pure and simple, except that some of the old-time restrictions are abandoned. The agreement is to be signed by the apprentice, and by his father or guardian.

1st. Applicants must not be over seventeen years of age when they enter the service of the company, and must serve until they are twenty-one years old. In case of absence during the term of service—unless such absence is occasioned by sickness—they shall serve such additional time as will make up for the time lost.

2d. Apprentices will first be placed under instructions in the "tool room." If, at the expiration of six months, the superintendent of the works finds the applicant untractable, or of a disposition other than mechanical, the company reserves the right to dispense with his further services.

3d. It is required of each apprentice to devote his whole time, during working hours, faithfully to his duty; those not observing these rules will be liable to be discharged.

4th. The wages to be paid each person so employed during his term of service, shall be as follows for time actually made:

For 1st year, at rate of $2.40 per week of 60 hrs.
" 2d " " " " " 3.00 " " " " " "
" 3d " " " " " 3.60 " " " " " "
" remainder of term at $4.20 per week of 60 hrs.

Thereafter, upon the faithful fulfillment of his term of service, each shall receive for the term served the additional sum of sixty cents per week for every week worked by him over two years.

5th. The right to discharge any such employe for indolence, negligence, or bad conduct (of which the superintendent of the works shall be the judge) is expressly reserved; and any one so discharged shall not be entitled to the extra wages to be paid as herein provided.

6th. Should the company at any time see proper to suspend wholly or in part the work in their shops, the wages of such employes shall be suspended, wholly or in part, according to the circumstances, until the company shall give them full or partial employment. No wages shall be paid when work is wholly suspended; and should there be a partial suspension, wages shall be paid at the rates herein fixed, proportionate to the time worked.

The labor agitation has frightened manufacturers so that they will not contract for convict labor, and many prisoners are idle at Charlestown, while their number is rapidly increasing.—*Springfield Republican.*

It is the unjust and ruinous competition of contract labor in prisons and penitentiaries that frightens independent manufacturers and workmen, and they propose to keep up the agitation until that kind of competition shall cease. The people of the State of New York agitated the question at the ballot-box to the extent of 139,000 majority to stop the contract labor system in prisons. Now the venal legislature won't provide for the employment of convicts in any sensible way, except for contractors. The day of reckoning is coming, however, and the wealthy prison contract rings cannot prevent it.

The *Railway Age* publishes a table to show that 1,755 miles of new railroad were built the first six months of this year, and the *Railroad Gazette* figures up 1,375 miles for the same period. The *Gazette's* estimates relate to main track only. Perhaps there were about 400 miles of siding built. We don't wish to discredit either statement.

Electricity for Practical Mechanics.

By GEORGE H. BENJAMIN.

FIFTH PAPER.

In my last paper I pointed out the difference between theory and practice, so far as the operation of dynamo-electric machines, as constructed for arc lighting, was concerned. We have now to consider the methods employed by exciting the field-magnets of machines adapted for incandescent lighting.

In the case of arc light machines, it was stated that the requisites were the generation of a current constant in quantity, but varying in electromotive force in accordance with the resistance of the external circuit, *i. e.*, the work to be done.

With a machine designed to operate incandescent lamps, the requirements are exactly the reverse—constant electromotive force and varying current in accordance with the resistance. With arc lamps, owing to their low resistance, it is usual to arrange them in series, that is to say, the current passes successively through the lamps in circuit, as shown in the diagram, Fig. 1, in which the large *D* indicates the dynamo-machine, and *A*, *B* and *C* the arc lamps. Hence it will be seen that with three lamps of three ohms resistance each, in series, the total resistance will be nine ohms, which resistance would be increased or decreased as one or more lamps are cut in or out of circuit. Incandescent lamps, on the other hand, owing to their high electrical resistance (varying, as commonly employed, from 30 to 150 ohms when cold, and about one-third less when hot), are usually arranged in "parallel," likewise called multiple arc. The diagram, Fig. 2, shows such an arrangement.

D indicating the dynamo, and *A*, *B*, *C* and *D* the incandescent lamps connected with the outgoing and ingoing leads *X Y*.

It will be observed that each of the lamps forms a bridge across the leads, and that the ends of the leads are not connected together to form a circuit, as in the case where lamps are in series. Each lamp cut in in parallel forms a new bridge, and completes the circuit through itself.

We will suppose that there are 10 lamps in parallel, and that the electromotive force of the machine *D* is 100 volts, and the electrical resistance of each lamp 100 ohms cold.

Now, for illustration, we will suppose that nine of these lamps are cut out of circuit; hence, by the formula $C = E \div R$, we find that a current of one ampere will flow through the lamp, this being the current required to incandesce the carbon filament of the lamp to the standard of 16 candle-power.

The quantity of current required for different makes of lamps varies from 0.6 to 1.7 amperes per lamp. If we now switch in nine more lamps, we do not, as in the case where lamps are arranged in series, add the respective resistances, but the reverse. That is, the resistance of the circuit will equal the resistance of one lamp, divided by the number of lamps cut in. In the present instance, the resistance of one lamp being 100 ohms, dividing this by the number of lamps gives us ten ohms as the resistance of the circuit, and 100 volts through ten ohms equals ten amperes. Consequently, each lamp will transmit one-tenth of the current, namely, one ampere.

The diagram, Fig. 3, will aid to a proper understanding of the reasons for this division of current.

Let *A* indicate the incoming conductor carrying a current of 1 ampere at a hundred volts, E.M.F. and *B B*, 10 shunt conductors, each of 100 ohms resistance, *C* the return conductor. When the current reaches the point of junction of all the conductors *D*, it has 10 paths of the same resistance open to it, through which it impartially divides itself, each path carrying $\frac{1}{10}$ of the current. If the conductors were of unequal resistance, as, for instance, are the shunt and series coils of a compound wound machine, the current would divide in the inverse ratio of their respective resistances, which, in plain language, means the path of least resistance (series coils) will carry the greater amount of current, and *vice versa*. It is, therefore, necessary to so design the machine that its power to generate a current will increase with the demands of the circuit, while the E.M.F. is kept constant. Fortunately theory and practice are not very far apart in this class of machine. A number of machines are now in the market, which at a constant speed will operate one or 300 16 candle-power lamps with no perceptible variations in the degree of E.M.F., and without requiring brush or other adjustment. The system of winding employed is that known as compound winding, and which is varied to form two types of machine, namely, series and shunt, the ordinary compound winding and compound long shunt.

Fig. 4 is a diagram showing the arrangement of coils on the magnets of the first type of machine, and that most commonly employed, namely, series and shunt, and which is nothing more nor less than a combination of the methods employed for winding a series or shunt machine upon a single pair of magnets.

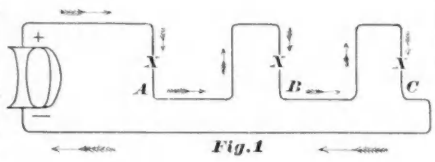


Fig.1

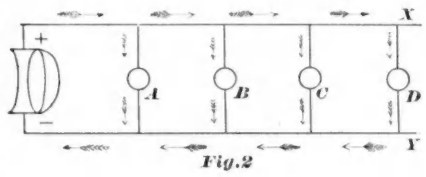


Fig.2

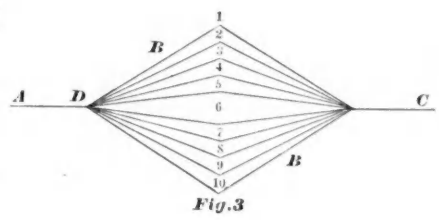
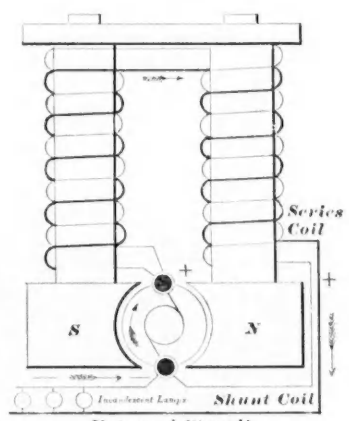
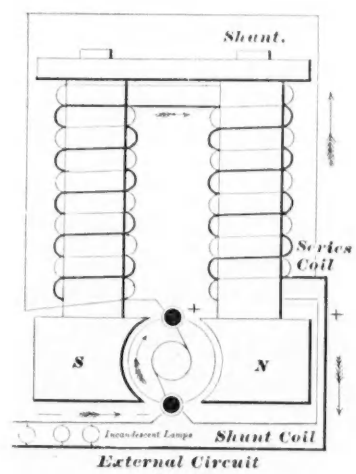


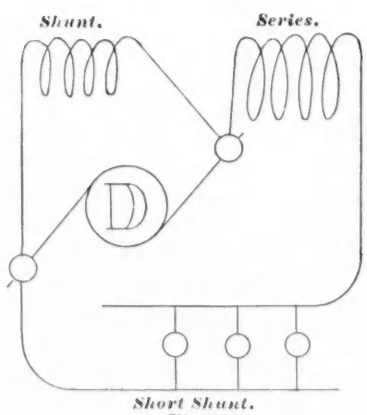
Fig.3



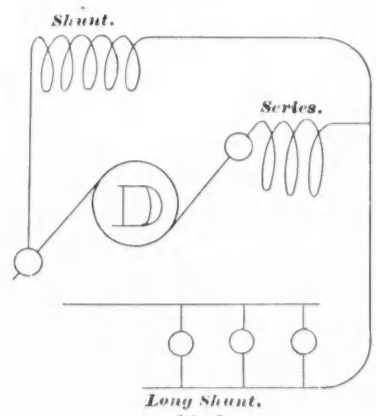
External Circuit
Fig.4



External Circuit
Fig.5



Short Shunt.
Fig.6



Long Shunt.
Fig.7

The current from the armature divides at the brushes, flowing through the shunt and series coils in the inverse ratio of their resistances when there is any work to do in the external circuit; when there is no work in the external circuit the series coils are idle, and the E.M.F. of the machine will depend entirely upon the magnetism imparted by the shunt coil.

Fig. 5 is a diagram of the arrangement of long shunt, the only variation from the last style of machine being that the shunt is across the external circuit instead of being across the brushes.

The principle of operation of these machines will be more readily comprehended by the diagram, Figs. 6 and 7. The shunt coils in each case are always closed, and with a given speed a uniform current will be circulating in such coils, whether the machine be doing any work in the external circuit or not. With the series and shunt machine there is a slight tendency to variation, but not enough to amount to anything. If the shunt coils be properly proportioned, the magnetism of the field will always be the same. When any work is to be done in the external circuit, such as feeding one or more lamps, the resistance decreases with each additional lamp cut in, as previously explained.

Then a current will flow in the series coils, and in amount depending upon the number of lamps. Hence the magnetism of the field will be increased, and the horse-power required to drive the machine will likewise be increased, the resultant being an increase of current proportional to the demands of the circuit.

Incandescent lamps have been operated by all of the different forms of dynamo machines described. But there is no system of winding so convenient for use, and adaptable for all conditions of circuit, as the compound winding just described.

Another manufacturing firm has started branch works in Schenectady to avoid labor troubles—at least that is the explanation offered in certain newspapers. The Fuller & Warren Company, of Troy, manufacturers of stoves, has bought an old foundry very cheap at Schenectady, and are going to do part of the work there. It is doubtless a good business venture, but why try to persuade workmen that the move is caused by labor troubles in Troy? Efforts to deceive workmen in such cases are almost always futile and foolish.

A well-known foundry man notes some of the difficulties in the way of foundries at a distance from where the castings are to be used, getting work. He mentions instances in which foundries at a distance from New York have offered to make castings from three-quarters of a cent to one cent per pound cheaper than they were being made in the city, but in nearly every instance the convenience of being near the foundry where little changes could be made in cores, bosses and such parts, outweighed in the minds of those who used the castings the saving in price. In some standard lines of work this convenience for making changes would not amount to much, but in a general line of machine shop work it is frequently of considerable importance. Taking machine shop work as a whole proprietors recognize the value of having foundry work done near at hand.

Sharp Cut-off or Throttling.

The impression is becoming unusually prevalent that there is, in locomotive engines, an enormous loss due to throttling for reducing speed rather than manipulate the reverse lever to cut off earlier. There is undoubtedly some truth in this, but there is also a good of sophistry. A locomotive engine is worked under peculiar conditions, that do not obtain in other steam engine practice. In the first place there is need of comparatively large cylinders and high pressure for starting the train, then as the speed is increased the cylinders are too large for the work to be done, working at the most economical point of cut-off. The economical point of cut-off is extended in the case of the locomotive engine from the fact that the cylinders are exposed to rapidly changing air currents, and also from the fact that considerable water is present in the steam; both of these conditions tend to move the best point of cut-off further along in the stroke. In stationary engine practice, under favorable conditions it is frequently found that, when the cut-off is short, and steam pressure high it is good economy to throttle to some extent, thus extending the point of cut-off and raising, considerably, the terminal pressure, and this is true in non-condensing engines when the terminal pressure is above the atmosphere; it is found advantageous almost always to do this rather than to reduce the boiler pressure. In the locomotive engine this gain from throttling, which to some extent superheats the steam, should be more marked than in the case of the stationary engine.

Throttling may be, and probably generally is carried too far by the locomotive engineer, but in average train service some throttling probably represents a saving in steam. Akin to throttling is the action of the link motion increasing compression as it is hooked up; it extends the point of cut-off, when working short, raising the terminal pressure, which may theoretically be wrong, but which is practically right. And this is one of the things that make it so hard to beat the link motion in actual practice. Theoretically it is the easiest thing in the world to show that the link is a great waster of steam; practically it is quite another thing to show this.

The use of natural gas is likely to have an important influence on the kind of fuel used in the future in many industries. That is, by the time natural gas supply fails, if it does fail, it seems probable that the convenience of gas as a fuel will have so impressed itself upon users that solid fuel will be at a discount. Gas can be made at the mines and carried in pipes under pressure, but at present there is the difficulty of cheaply purifying the gas of the tarry products that soon clog the pipes, and decrease and finally stop the flow. Means of doing this at little cost would assure the continued use of gaseous fuel, in manufacturing, in many parts of the country.

Many old broken-down, substantially bankrupt cities lay in wait, as it were, for live manufacturing establishments, taxing them to the utmost, eventually driving them to move elsewhere, and setting up an effectual warning to others not to locate there. Manufacturers are coming to look closely to the financial management of city's affairs before they conclude to build works. Those who manage the municipal affairs of cities, or those who are pecuniarily or otherwise interested in their welfare, would do well to devote a few hours to studying the pecuniary advantages of manufactories, the workmen of which scatter around money, most of which comes from elsewhere.

American Railway Master Mechanics Association.

REPORT OF MASTER MECHANICS COMMITTEE ON THE BEST PLAN OF REMOVING, CLEANING AND RE-SETTING FLUES.

To the American Railway Master Mechanics Association:

Your committee to whom was referred the subject of "The best plan of removing, cleaning and re-setting flues," would report that they issued the following circular of enquiry to all members of the association:

OMAHA, April 28, 1886.

TO THE MEMBERS OF THE AMERICAN RAILWAY MASTER MECHANICS ASSOCIATION:

GENTLEMEN:—The undersigned have been apointed as a committee to ascertain the best plan of removing, cleaning and re-setting flues, and respectfully solicit answers to the following questions:

1st. What, in your opinion, is the best method of removing flues? Please describe in detail.

2d. Have you ever removed flues by the aid of a locomotive or other power? If so, please give experience.

3d. Does the manner in which flues are set affect the plan of removal? If so, how?

4th. What do you consider the most economical and thorough way of cleaning flues after they have been removed from boiler?

5th. What have you found to be the best manner of re-setting flues?

6th. What material do you consider the best for flue ends?

7th. Have you found it more satisfactory to weld or to braze ends to flues?

8th. Does the character of the water or fuel used in any way govern the manner of doing above work? If so, please state in what particular.

As far as possible, send with your report drawings or sketches, giving dimensions of all special tools or devices.

That the committee may be enabled to make as complete a report as possible, and one analyzing the subject under all conditions, they would request members not to confine their reports to direct replies to questions, but give all information obtainable.

Please send reports at as early a date as convenient to Clem. Hackney, Supt. M. & R. S., U. P. Ry., Omaha, Neb.

CLEM. HACKNEY.
A. W. SULLIVAN.
G. H. PRESCOTT.

We have received answers, all more or less complete, from twelve members, as follows:

Question No. 1. What, in your opinion, is the best method of removing flues? Please describe in detail.

Answer. Four cut-off flues inside of front flue sheet.

Two members say they split forward end of flue about 1 in. inside sheet. One member reports that if flues are not badly scaled, his practice is to turn down the bead in fire-box end and drive them out. If scale has formed on them to such an extent as to prevent their removal readily, take out the dry pipe, cut off flue end inside of fire-box flue sheet, turn down bead on front end, and drive flues into the boiler. Five do not give particulars. Of the whole number, three report using a hook cutter, and two report using a cutter bar to cut off flue ends. Others do not use special tools. Eleven say they take flues out through dry pipe opening when all are to be taken out, but use one of the tube holes in front flue sheet, enlarged for the purpose, where only a few (thirty or forty) flues are to be removed. One member always takes the flues out through an enlarged hole near bottom of front flue sheet.

Question No. 2. Have your ever removed flues by aid of a locomotive or other power? If so, please give experience.

Answer. Mr. Allen Cooke, of the Eastern Illinois Railway, says he has removed flues with a locomotive, but does not think it pays.

Mr. Wm. Swanston, of the C., St. L. & P. Railway, has tried to draw flues through the front flue sheet, but without success.

Mr. Jacob Johann, of the Chicago and Atlantic Railway, has used an engine to pull out a few flues, but gave it up for the reason that it strained the flue sheet, and ground the holes out of round. A better way, he thinks, when only a few bottom flues are to be taken out, is to ream out one hole, about one-eighth of an inch, and draw the flues with a windlass of two inch round bar iron, to extend across front end, and to rest on two of the front end studs; in each end of this bar should be a one-inch hole for 7/8 in. lever, in center of bar to be an eye bolt, with chain attached; to use, cut bead, etc., off both ends of flue, and drive it out 6 in., attach chain, and draw flues out with windlass.

Mr. Wm. Montgomery, of the P. & R. Railway, says he never used a locomotive for this purpose, but has witnessed the experiment and considers it very dangerous, on account of liability to break the bridges between holes in flue sheet.

One other member reports using a windlass, but does not describe it.

Question No. 3. Does the manner in which flues are set affect your plan of removal—if so, how?

Answer. Nine members report that the manner in which flues are set does not affect their plan of removal.

Mr. Wm. Montgomery, of the P. & R. Railway, says that putting copper ferrules on fire-box end gives some trouble in drawing flues through front flue sheet. He sets the flues in back end with a tool which enlarges the flue and ferrule inside the sheet.

Mr. Jacob Johann says that in using the "Prosser expander" the piece left after cutting off the end is a trifle harder to get out of the way.

Mr. R. C. Blackall, of the D. & H. Canal, reports that flues set with the "Prosser expander" are more difficult to remove than those set with the "roller expander" on account of shoulder being formed on inside of sheet.

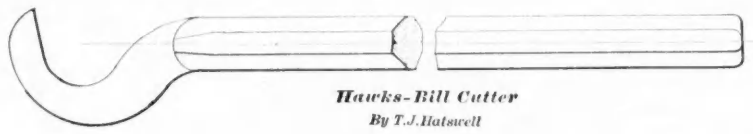
Question No. 4. What do you consider the most economical and thorough way of cleaning flues after they have been removed from the boiler?

Answer. Ten members report the tumbling barrel as the best means of cleaning flues.

Mr. Wm. Swanston, of the C., St. L. & P. Railway reports that for the past 18 months he has been using an Otto flue cleaner, manufactured by the Flanders Machine Company, and regards it as the best appliance, for the purpose, he has seen.

One member scrapes his flues, but has had no experience with any other method.

Mr. T. J. Hatswell, of the F. & P. M. Railway tumbles his flues in water.



Hawks-Bill Cutter
By T. J. Hatswell

Flue Crimping Tool
By Allen Cooke

Mr. J. S. Graham, of the L. S. & M. S. Railway, in speaking of tumbler used by that company, says: Tumbler is made of an old boiler, lengthened to suit, and is run at a speed of thirty revolutions per minute; can clean forty-five to fifty flues at a time, in one to two hours. Thinks this form of tumbler especially good, as the rivet heads, on inside of sheet, find the poor flues by indenting or breaking through the thin spots.

Mr. Jacob Johann thinks a few hard clinkers should be put in with the flues, and the tumbler speeded just fast enough to carry the flues to the top center, letting them drop before they pass that point; thinks that the drop does the work much more effectually than the mere rolling of the flues over each other.

Question No. 5. What have you found to be the best manner of resetting flues?

In resetting flues, hardly any two of the members do the work exactly alike, and we give method employed by each.

Answer. Mr. R. C. Blackall says that their practice is to anneal both ends of tube, drive on swedge to take off bur, and compress ends for copper liner, expand with "Prosser tool," bead and calk, then finish lightly with Dudgeon roller.

Mr. W. Woodcock, of the N. J. C. Div. P. & R. Railway, uses the Prosser expander, and thinks it the best, because flues are set out between sheets and form a stay; uses the Dudgeon roller to set flue out to fit sheet; also uses the latter tool for repairs.

Mr. Allen Cooke says: Drill hole for 2" flue 2 1/16"; use copper ferrule to bring diameter of hole down to 1 29/32"; secure ferrule in hole with Prosser expander; swedge flue ends taper for driving fit; expand hot, with mandrel to fit flue holes in front end. As fast as flues are driven home, expand with Prosser expander enough to hold in place until all are in; then use expander hard enough to set flue out tight, and form collar inside, so that sheet is held between collar and bead; tap flue with ball hammer, and bead with heel tool, being careful to always work outwards, working flue over copper and making small bead; use Dudgeon's expander lightly to finish with. Thinks it pays to bead front ends, as flues make a better brace for sheets by doing so.

Mr. T. J. Hatswell uses copper ferrule on fire-box end; uses Dudgeon expander, and beads flue over the copper; gives no particulars as to front end.

Mr. C. W. Mills, of the R. & P. Railway, says: Set flues and roll with Dudgeon expander. No particulars.

Mr. John Player, of the C. I. Railway, reports that the best manner that they have found is to use the copper ferrule, and roll or expand with the Dudgeon expander.

Mr. Jacob Johann says he prefers to have the flue holes in back flue sheet a trifle less in diameter than flues, and after grinding the rust off the end of flues with an emery wheel, to drive them into place; flue holes in front sheet to be two and one-sixteenth inches in diameter for two-inch flues, to allow for light copper ferrule. He says, however, that many of the engines now on that road have flue holes in back sheet 1 3/4 inches in diameter; this necessitates swedging down the back ends of the flues, and the holes are so badly out of round that copper ferrules have to be used in order to make a joint

Mr. J. S. Graham knows of no better method than rolling front end and rolling and beading back end. He uses a roller turned to the same taper as the spindle, but reversed, so that the large ends of the rollers shall come on the inside of sheet when used, insuring a joint at that point first.

Mr. Wm. Swanston says the best plan they have tried for doing this work is to bore the holes in the flue sheet 1/16 inch larger in diameter than the flue, swedge or die the fire-box end of flue down 1/32 inch, and braze on a copper ring, this to be filed off to a driving fit in sheet. On the front end the scale is removed from flue, and a light copper ring inserted (but not brazed) between sheet and flue. Use the roller expander, and bead fire-box end. Do not consider it necessary to bead front end.

Mr. Wm. Montgomery reports that they have found the best manner of setting flues to be as follows: Swedge down fire-box end one-sixteenth inch, file the end off bright, and put on a copper thimble to bring flue up to size; set with Dudgeon expander; then use tool to form a groove or enlargement of flue just inside sheet, making a joint next the water; bead flue on outside of sheet. This makes a firm job, and one not likely to be loosened by expansion of the flues.

Mr. Geo. Hackney, of the A. T. & S. F. Ry., uses copper bushings expanded to fit holes in flue sheet, end of flue to be ground smooth on emery wheel, placed in a position and expanded with roller, only fire-box end beaded.

Mr. G. W. Stevens, of the L. S. & M. S. Ry., expands with roller, and flanges with thumb tool.

Question No. 6. What material do you consider the best for flue ends?

Answer. Nine members say that they consider good soft iron the best material for flue ends.

Two use semi-steel.

Mr. T. J. Hatswell says: Uses ends of the same material as the body of flues.

Mr. Montgomery says that he thinks that it will pay to put ends of good charcoal iron on new flues.

Mr. W. Swanston reports having tried flue ends of steel and semi-steel, but without much success.

Question No. 7. Have you found it more satisfactory to weld or to braze ends to flues?

Answer. Eleven members report in favor of welding ends to flues.

Mr. Jacob Johann says either welding or brazing can be made satisfactory, and he thinks there is little difference between the two methods: says he knows from actual experience that when fitted up, with special tools for cutting off, scarfing, and brazing, that the brazing can be done much cheaper than welding, and always insures a straight flue; in brazing much cheaper labor can be employed than in welding. The first cost of fitting up for brazing would be greater than for welding, but thinks that the difference in cost of doing the work would more that offset this; more flues can be brazed than welded per day, with a given number of men. A description of special tools used by him for brazing is now in possession of your association.

Mr. W. Swanston says: We only resort to brazing when flues are of so poor a quality as to give trouble in welding.

Question No. 8. Does the character of the water or fuel used in any way govern the manner of doing the above work? If so, please state in what particulars.

Answer. Eight members report that neither water nor fuel materially affect the manner of setting flues.

Mr. Wm. Swanston thinks, with good soft water it would not be necessary to use copper rings, and that as good results would be obtained by setting flues iron to iron, but with water of that section copper is a decided improvement.

Mr. Jacob Johann thinks that flues tight with one kind of water and fuel will be tight with another, but thinks that they may make a decided difference in the length of time flues remain tight; says the softer and freer from sediment the water is, and the more free from sulphur the coal is, the longer the flues will last; thinks also that the length of time that the flues will last depends materially on the engineer.

Mr. Montgomery says that they use the same engines for both hard and soft coal, and he does not see any especial difference, but that the beads on bottom flues burn off faster with hard than with soft coal. Uses in some cases cast iron ferrules, which he thinks are an advantage; does not think that the quality of water affects the method of setting.

Mr. W. Woodcock uses a "Saddlers" patent flue welding machine; the weld is made by revolving rolls and it is a very simple and effective machine.

Mr. Allen Cooke sends sketch of crimping tool, which find attached.

Mr. T. J. Hatswell sends blue print of Hawk's Bill for cutting off flues, which please find attached; he also gives price of taking out welding and resetting one flue by hand, at 17 cents.

From the reports furnished, and from our own experience, we have reached the following conclusions:

First. The best known method of removing flues is to use a cutter bar to cut off flues inside of front flue sheet, and turn down bead on back end; when all flues are to be taken out, take out dry pipe and take flues out through dry pipe opening; when only a few flues are to be removed use one of the tube holes in front flue sheet enlarged for the purpose.

Second. Taking all of the circumstances of the case into consideration, do not consider it advantageous or economical to use locomotive or windlass to remove flues.

Third. The manner in which flues are set does somewhat affect the plan of removal, but in consideration of the great importance of having flues set to give the most efficient service in practice, do not think the difference enough to be considered a factor.

Fourth. Consider the tumbling barrel as the best known means of cleaning flues.

Fifth. Know of no better method than rolling front end and rolling and beading back end, use copper ferrule expanded to fit holes in flue. Flue to be placed in position and expanded with roller, do not consider it necessary to bead front end.

Sixth. Consider good soft iron the best for flue ends

Seventh. Have had no trouble from either brazed or welded flues with proper flue welder; have every reason to believe welding is cheaper.

Eighth. Would recommend manner of setting as explained above for all kinds of water or fuel.

Your committee have not received or prepared drawings of flue welders or other special tools, but feel assured it would prove of great advantage to have such gotten up, and that the above subject deserves further investigation by the members of this association.

Respectfully,
CLEM. HACKNEY,
Chairman.

DISCUSSION.

Mr. Johann—About five or six years ago, when I was in charge of the Wabash establishment, at our Springfield shops we brazed the flues, and at our Fort Wayne shops we welded them I had special machinery at the Springfield shops for brazing, and they had special machinery at Fort Wayne and the Moberly shops for welding. I instructed the master mechanics to make a special trial to see what the comparative cost was of brazing and welding; and to that end I ordered them to take 300 flues, just as they came out of the boiler, with the scale and everything on, which was done at each shop at about the same time. They went in to be cleaned off; were brought out, trimmed off and brazed. If I remember rightly—I am not quite positive on the subject—the manipulation of the 300 flues they welded at each of the shops, at the Fort Wayne shop and at the Moberly shop, cost somewhere between $24 and $28, all told. The brazing cost between $16 and $17. That is as near as I can remember now.

Mr. Campbell—I move that the committee be retained and continued for another year, for the purpose of getting all the figures in reference to the brazing and welding of flues.

The motion was carried.

Mr. Blackwell—It appears to me, from what I have heard of the report of the committee on this subject, that information has not reached them of the use of the cutter used on the inside of the flue, acting the same way as a pipe cutter, only reversing it, the cutters being on the inside of the pipe instead of the outside. I may state that before I left the Northwestern Railroad one of my foremen got up an apparatus for effecting this purpose, and it worked in the most admirable manner.

Mr. Campbell—Is that used by machine tool or by hand?

Mr. Blackwell—It was a hand tool. It was made to be automatic. It was inserted in the tube, and after a certain number of revolutions the tube was cut.

Mr. Meehan—Mr. President: The method of cleaning tubes, I think, is a very important one. I see there are several milling machines in existence now as compared with the rattling machines, and I do not think they are an improvement. I notice that the milling machines do not take off the carbon scale on the inside of the flue, while they make a beautiful job on the outside. We carried out some tests on that point, and found the carbon scale on the inside of the flue is very detrimental to the heating qualities. I know that there is some coal that leaves that deposit more than other kinds of coal. Our coal is very bad for that, and I thought perhaps it might be overlooked, and that is the reason why I wanted to call the attention of the members to it.

Mr. Setchel—There is a question which has interested me somewhat. It is whether it is necessary in practice to bead the flues in the front end. I know that a great many roads never think of doing that; and the committee recommend in their report that it is unnecessary to do it. I should like very much to test the sense of this convention as to whether, in their opinion, it is necessary. In my experience, for thirteen or fourteen years, I have been in the habit of only just rolling the flue out at the front end, and letting it stick through the sheet a quarter, three-eighths or five-sixteenths of an inch, as the case might be, and never have any trouble caused by doing that. If that can universally be done, it is certainly quite a saving in expense.

Mr. Campbell—I have been doing that for the last five years, rolling them out. I do not bead them on the front end. I do not have any trouble with them at all.

Mr. Setchel—I move that it be the sense of this convention, as a body, that it is unnecessary to bead flues in the front end as a practice.

Mr. Lauder—I would like to say just one word. There may be some of our younger members—probably there are not—who might think that, if it was a good idea to leave the flues beaded at the front end, it would also save expense and be a good idea to leave them without beading at the back end. That has been tried, and it has been found that if they are not beaded at the back end the mechanical action of the sparks and other sharp products of combustion, being thrown by the blast against the flue-sheet, will strike against that projecting lip, and cut away the flue-sheet between the flues.

Mr. Johann—I do not hardly see that there is any necessity for the association expressing their preference in that matter. I think that after we pass that resolution we will all go home, and each one will set his flues about as he wants to.

Mr. Setchel—The gentlemen do not seem to understand the object of my motion. The idea is simply to get at the opinion of the members of this convention. We thought it was necessary, for years, to bead flues in the front end. There is a large number of the leading roads, largely the Pennsylvania Central, especially on the Western lines, none of whom I believe bead the flues in the front end. I did not introduce this for the purpose of compelling anybody; that is not the idea. Now, the committee say that it is unnecessary, and I myself believe that it is entirely unnecessary. And in these days of sharp competition, when everybody is trying to cut his expenses down just as low as possible, it seems to me a very great matter if we can save $5, $10 or $15 on an engine by not beading the front end of the flues. It is something important to act upon and to have adopted.

Mr. Briggs—I have had occasion lately to renew my flues on account of bulging in the boilers, etc., and I have had several inquiries made of me as to whether or not it was best to bead at the front end. I began to run a bolt from one end to the other to draw the sheet back, and I have finally concluded that I had better bead the front end, and allow the flues to act as a stay. My practice now is to bead about twenty or thirty in the center of the boiler; and I think, as regards strength, that beading flues should be just the same—at least until we get within about four flues of the shell all around.

Mr. Allen Cook—I fully agree with Mr. Briggs as regards beading flues in the front end. I do it for a stay. I think it requires staying between the flue-sheets as well as anywhere else. My reason for doing that was because the flue-sheet bulged, and, if you are going on with your great high pressure that they are talking about now-a-days, I think they would require staying still more. I bead my flues on the front end, thinking it is better.

Mr. Johann—I wish to rise just to make a personal explanation. If the members understood me to say that I didn't believe in discussing these matters, I simply didn't express myself clearly. What I meant to say, if I didn't say so, was that I didn't think it was necessary to take a vote on this matter as the sense of the meeting. I believe in discussing it, but do not see that we want to adopt it as the sense of the Association that it is best to do this one thing. There are generally two or three members that do about all the talking. Why? Simply because the others don't get up.

Mr. Briggs—The opinions of this Association are considered as authority for the guidance of others outside of the Association, as well as among its own members, in mechanical practice. We want to get some idea from the Association in reference to beading flues. And we shall try to educate the people as to what we think is the best plan for putting in a flue. If it is a necessity to bead at both ends, let us say yes or no; and let it be authoritative; and do not pass it over as a common-place affair. To-day there is not one man in twenty in this Convention that is apparently willing to bead flues at each end. I think it is a matter of mechanical necessity to bead the flues in a large boiler at each end, to a certain extent. I do not believe it is necessary to go way around to the shell of the flue.

Mr. McCrum—My experience in this matter has been very similar to that of Mr. Briggs and Mr. Cook. When we had smaller boilers, I used to set a great many of my flues by expanding them at the front end, and not beading them. After we had larger engines, carrying heavy pressure, I experienced some difficulty about the back sheet bulging out and drawing the flues through the sheet. Consequently I adopted the practice of beading the flues at both ends. I think it is a necessity. It may not be necessary to bead entirely around the outside, but while I am beading the majority of the flues, I will bead them all.

Mr. Black—It was formerly our custom to do just as Mr. Briggs does, but of late years, we take the front flue sheet, calk it for three or four inches, and set it in; and the pressure coming against that stays it up. We know the sheet is put in straight, the stay or collar coming out on the center, in order to stiffen the sheet. The other way, we find, is a very much better way; it don't require any beading at all.

Mr. Lauder—I think the question of the necessity of beading flues in large boilers rather than small ones, if it is a necessity, is not attributed to the right cause. If the flues are set three-quarters of an inch apart, there is no more weakness in the sheet in a large boiler than in a small one. The flues act as stays. The only pressure you get in either case is in the space between the flues. I attribute the difficulty to which Mr. Briggs alludes entirely to a defective circulation of the water. The back head gets overheated, and pulls off the flue, or expands and bulges it. I can see no reason, if the water expands properly, why there should be any more necessity for beading the flues in a large boiler than a small one, unless the flues are set further apart and give more pressure surface between them for the pressure to act upon. I am well aware that our friends in the West are troubled with bad water, bad circulation, scales and lots of things that we do not have in the East at all. For example, we can set flues here and have them run fifteen years, and not touch them. It is largely a matter, I think, of locality, of the circumstances that surround the case in the different localities. With good water, most anything will do in the way of a fastening for the flue. With bad water, possibly a bead makes it a little more secure.

Mr. Briggs—I want to set myself right. I will admit that if you use the Dudgeon expander, it is virtually what you might term a part of a bead on each side of the sheet. But the question is, Are we simply to roll the flue in the front? And the members all said here at one time that they thought that was sufficient; and they wanted the sense of the association to be recorded as being in favor of that. That is what I am opposed to; but if you use the Dudgeon expander, that is all I have got to say.

Mr. Lauder—I will say that any expander, any modern tool for setting locomotive flues, will do what seems to me about the same thing. The roller does better, and makes a better job. I supposed, of course, that in setting iron flues, every one used the roller or some equally efficient means for setting their flues.

Mr. Ackley—I am in about the same location as our friend McCrum, only a great deal worse, as regards bad water. We have some very bad water and very large boilers. We do nothing with our front ends but roll them. We have never had any trouble with sheets rolling or bulging or anything of that kind. We bead the back end, and roll the front end. We do not keep flues in over five months, on account of the boilers filling up with mud. We had no trouble at all about it with them for six or seven years. Our boilers run over sixty inches in diameter, and we have no necessity at all for beading them on the front end, either in the center or anywhere else.

Mr. McCrum—What expander do you use?

Mr. Ackley—A roller.

Mr. McCrum—A plain roller?

Mr. Ackley—Yes, sir.

Mr. Briggs—I would say, in reply to Mr. Lauder, that the distance between our flues is three-quarters of an inch, which I presume is about the usual practice in the West; and in the case of the large boilers that I speak of, where the flue sheets were sprung, the boilers were comparatively new. Of course the back sheets were straight; they were not concave. I never have been in the habit of concaving flue sheets or having any concave flue sheets. It was the front sheet that you concaved, Mr. Black, wasn't it?

Mr. Black—Yes, sir.

Mr. Briggs—Of course, the method of setting our flues is with the Dudgeon expander.

Mr. Hackney—Which end of the boiler do you refer to?

Mr. Briggs—The back end.

Mr. Hackney—That shows to me plainly that the front end expanded with the roller is sufficient for that job, if a beaded end will pull out.

Mr. Stevens—It is our practice to bead the flues at both ends, for the simple reason that has been set forth by Mr. Briggs and several others—strengthening the boiler. I notice that in Mr. Lauder's remarks he said that the larger boilers had no more pressure or no more load to carry than the smaller ones. If he could demonstrate that, it would be one of the unique things.

Mr. Lauder—If I was so understood I am very glad Mr. Stevens brought the matter up. I will admit that there is more aggregate pressure, but there are also more stays in the form of flues. There is no more strain on each individual flue, no more pressure to pull each individual flue through the sheet in a large boiler than there is in a small one, provided they are all the same distance apart. There is no more danger of a flue pulling through this plate in a large boiler than there is in a smaller one, because there is no more strain upon it if the flues are all set three-quarters of an inch apart, or the same distance apart. I think there is no necessity for beading either end as far as strength goes.

Mr. Briggs—I would like to ask Mr. McCrum if he did not always observe that when his back flue-sheets left the flues the beads had either been broken off or been worn off by abrasion?

Mr. McCrum—Yes, sir; it was usually when the flues had had considerable wear, and the beads had become somewhat weakened.

Mr. Miles—I think it is very important that we should record our vote upon this question. There is one point that has been overlooked in the discussion. It is this: The difference of expansion in the boiler shell and the tube. Some of the members have stated that they bead the front end of the front tube-sheet in order to stay the boiler. I think if they beaded these flues when they were cold, that when the boiler was fired up the tubes would not be very much of a stay; because with fire through them and hot water around them there would not be very much stay to the boiler right there. But as some of the members think that front ends of the tubes need not be beaded, and others think that they do need to be; and as some may think that if they wanted to stay the boiler they might bead the flues a certain distance, and not bead others; and as Mr. Hackney has stated that the front end of some pulled out—it seems to me that, for the guidance of those who choose to take any guidance, we should vote upon the secretary's motion.

Mr. McKenzie—Some years ago we had considerable experience in the matter of beading tubes on the Kansas City & Union Pacific Road. We were, at that time, like Mr. McCrum and Mr. Hackney and others, troubled with very bad water; and we found it was almost an impossibility to keep the flues from leaking in the front end of the boiler. Our practice at that time was to roll the flues in the front end and bead them in the back end with a copper ferrule. I said to our boiler maker that we would try some other method, and suggested that we bead them on the front end. We did so, and put the engine under test with another one, both engines having their flues put in at the same time. They were put on the division about 400 miles west of Kansas City. The engine that had the flues beaded in the front end never gave us any trouble, while the one that was not beaded was continually leaking. I do not believe the engine had made 400 miles before the flues had to be tinkered. It may have been that we did not know how to put the flues in with the roller expander, but we were very carefulabout it, and I think we rolled them as well as it could be done. I think the majority of the Western men will say that the flues should be beaded on the front end. So far as the staying of the flues is concerned, I apprehend that the temperature of the water would regulate that somewhat, and the center of the boiler would expand about as much as the flues; so that the staying of the flues would not amount to anything.

Mr. Collier—It has been our custom in the South, and more especially on the roads with which I have been connected for twenty-six years, to roll our flues at both ends. We never have had any trouble with them. It is the sense of this convention that it is useless to roll the flues on the front flue-sheets——

Mr. Setchel (interrupting)—The recommendation of the committee was that it was not necessary to bead, not that it was not necessary to roll them, and that was my motion.

Mr. Collier (resuming)—If rolling alone will answer in the front flue-sheet, then it is a question of economy not to bead. I have never failed to bead, and always had good results from it; I never had any flues pull through, and never had any flue-sheets crack.

The President—The motion is that it is the sense of this meeting that it is not necessary to bead flues at the front of the smoke-box.

Mr. Campbell—I call for the ayes and nays.

Mr. Gentlee—It is the practice on the road with which I am connected, and has been for years, to bead the flues at both ends. Our master mechanic is not present at this meeting. I cannot say that I fully agree with him, and, under the circumstances, I would like to be excused from voting. Understand me that we bead our flues there exclusively.

Mr. Blackwell—I move to amend by adding the words "When good water is used." It makes a great difference apparently.

Mr. Stevens—I would like to ask you what good water is?

Mr. Blackwell—I should call water good if you could run six weeks or two months without washing out your boiler. I should call that very good water.

Mr. Lauder—I hope Mr. Blackwell won't insist upon that amendment, because we have evidence here from gentlemen that are connected with roads which have as bad water as there is in this country that they do not bead their flues, and we have evidence from roads that do have good water that they do not bead them. You might say that all roads east of the Hudson River should be excluded from voting on this question. I will agree to that. We are not much interested in it. It don't make much difference to us.

Mr. Blackwell—I will withdraw my amendment.

The President—Those in favor of the motion that, in the sense of this meeting, it is not necessary to bead over flues at the smoke-box tube-sheet will please manifest it.

Forty-six members believed that it was not necessary, and twenty-nine that it was.

LETTERS FROM PRACTICAL MEN.

Universal Table for Lathe Change Gears for Screw Cutting.

Editor American Machinist:

Your correspondent, whose letter you refer to me, can use the table I gave for the change gears for screw cutting for practical pitches as follows:

Take a list of the change gears the lathe has, and arrange them in a horizontal line at the head of the table, and put the same list in a vertical line at the left-hand end of the table as below.

At the same time, if practical pitches are wanted, fill in all the numbers in the left-hand column; then put in the threads per inch (which I have in the accompanying table put down as 3 for the coarsest); put in the row of threes, then the row of 3¼, then a row of 3½, and so on, and then put down the pitch of the lead screws, the first pitch of lead screw being 3, because the coarsest thread the table is for is 3 per inch.

You will see that the table makes itself, as there is no calculating whatever to do.

Number of teeth in the wheel that is to go on the lathe stud.

Number of teeth in the wheel that is to go on the lead screw	12	16	20	24	28	32
12	3	3	3	3	3	3
13	3¼	3¼	3¼	3¼	3¼	3¼
14	3½	3½	3½	3½	3½	3½
15	3¾	3¾	3¾	3¾	3¾	3¾
16	4	4	4	4	4	4
17	4¼	4¼	4¼	4¼	4¼	4¼
18	4½	4½	4½	4½	4½	4½
19	4¾	4¾	4¾	4¾	4¾	4¾
20	5	5	5	5	5	5
21	5¼	5¼	5¼	5¼	5¼	5¼
22	5½	5½	5½	5½	5½	5½
23	5¾	5¾	5¾	5¾	5¾	5¾
24	6	6	6	6	6	6
25	6¼	6¼	6¼	6¼	6¼	6¼
26	6½	6½	6½	6½	6½	6½
27	6¾	6¾	6¾	6¾	6¾	6¾
28	7	7	7	7	7	7
29	7¼	7¼	7¼	7¼	7¼	7¼
30	7½	7½	7½	7½	7½	7½
31	7¾	7¾	7¾	7¾	7¾	7¾
32	8	8	8	8	8	8
	3	4	5	6	7	8

Pitch of the lead screw.

All your correspondent has to do, therefore, is to make such a table, and he can at once find the wheels for any pitch. It is quite

true that these may not be the only wheels in the set that will cut the required pitch, but that is of no consequence, as the table gives wheels that will cut it.

But if other wheels than those given by the table are required to be used, they can be found from the table as follows:

Take a case in which a man wants to cut, say, $3\frac{1}{2}$, the pitch of lead screw being 3, and the table gives—

Teeth for wheel to go on lathe stud 12
—
Teeth for wheel to go on lead screw..... 14

Then take this fraction and multiply it by 2 ($\frac{12}{14} \times 2 = \frac{24}{28}$), and 24 and 28 are the wheels.

Those who wish to verify the table can easily do so. Suppose, for example, a lead screw has a pitch of 4, and you want to cut $4\frac{1}{4}$, and you put both into quarters in this way:

In the pitch of the lead screw there are 16 quarters.
In the thread to be cut there are 17 quarters.

And 16 and 17 ure the wheels given in the table.

No error can arise as to which wheel is to go on the stud and which on the lead screw, because the wheel found at the head of the table is in all cases the one to go on the head of the lathe, and that found at the left-hand end of the table is the one to go on the lead screw, which is at the left-hand end of the lathe.

While on this subject, I may remark that this subject of thread cutting is a very interesting one, and in some of its aspects is not as well understood by many as it is desirable that it should be. A universal table such as I have devised was pronounced by one of your correspondents, a year or two ago, to be an impossibility, and I have seen shapes of tools given for screw cutting that it would be quite impracticable with the most expert workman to cut a proper thread with.

The origination of an accurately-shaped thread is as nice a mechanical problem as I know of, and I have seen it stated several times in print that Whitworth originated the round tops and bottoms of his standard threads with a file. There is, however, a method of originating threads that is absolutely accurate, and that corrects and proves itself, let the shape of the thread be what it may, and on this subject I hope to find time to send you a further communication.

JOSHUA ROSE.

Grinding Machines.

Editor American Machinist:

In the AMERICAN MACHINIST, July 3, is a description, by Joshua Rose, of a machine for grinding rolls, which he states is intended for a part of a new book to be published, on "Modern Machine Shop Practice."

I hope Mr. Rose will pardon me for making a few critical suggestions, as I do not make them in a fault-finding spirit. He undoubtedly wishes to make his book a reliable source of information, and as such, I think, his "grinding lathe" could not be recommended for accurate work.

A few timely suggestions may be beneficial to the author, as well as to the reader of the prospective book.

In the first place, I think that the statement "that the truth of the roll does not depend upon the truth of the guideways along which the carriage traverses," will not stand a practical test. In the second place, the swinging carriage, instead of providing means of doing accurate work with a poor machine, is an absolute source of weakness and inaccuracy.

In what I suppose is meant for Fig. 1,* the swinging carriage is shown suspended on circular bearings, and in Figs. 2 and 3 the upper support seems to be intended for knife-edge bearings. If the journal bearings are used, there will be more or less frictional resistance in addition to the inertia of the swinging carriage, and in proportion to this resistance the swinging carriage will act as though the emery wheels were supported directly by the sliding carriage. This would require the carriageways to be parallel with the axis of the roll to do good work. It is true, as stated, that if the roll is out of line even as much as $\frac{1}{16}''$ in a vertical plane—one end higher than the other—it will not affect the accuracy of the result very much; but it will some. But if the roll is out of line in a horizontal plane, the difference in diameter will be equal to twice the amount it is out of line with the ways.

On the other hand, if the swinging carriage is suspended on knife edges, and the resistance to swinging reduced to the least possible amount, then the roll will "act as a guide" to conduct the wheels wherever the irregularity of the roll may carry them. If the roll, at any point, rotates eccentrically it will impart a reciprocating motion to the swinging carriage, causing the roll to be ground first on the "high side" and then the momentum of the swinging mass will cause the other wheel to dig into the "low side"—just what is not wanted—unless the roll be rotated quite slowly.

In regard to the manner of driving the emery wheels, as shown in Fig 2, nothing has been said; but it can be plainly seen that the action of the belt would be to draw the swinging carriage to one side or the other, according to the direction it was running. Of course this could not be allowed under any circumstances whatever.

Again, in order to have a roll run true when finished, its journals, as well as its body, should be ground true, and all this grinding should be done on the same centers to insure concentricity. The reason of this is self-evident, and further explanations are unnecessary. In consideration of this fact the unmechanical method of taking the roll from the turning lathe and grinding it with its untrue "journals resting in the bearings *B*" needs no further attention to show the incorrectness. How the journals are to be ground has not been explained.

There are grinding machines in the market for doing such work accurately, though but one emery wheel is used. The accuracy of the work produced is not affected by the wear of the wheel in these machines. There is no advantage in using two emery wheels, except that the work can be done in a shorter time than it can with one wheel.

C. A. SMITH.

Pawtucket, R. I.

* The diagrams here referred to will be found in the article above cited.

Concerning That "Air Trap"—Unequal Shrinkage in Duplicate Castings.

Editor American Machinist:

F. B. Rice asks, through the AMERICAN MACHINIST of July 10th, for an additional explanation about the "air trap." I cannot answer the question, although it seems less mysterious than the condition which follows, that is, when the water enters the vertical pipe and stands on a column of air, why they do not change places? I believe the physicists have some explanation for this, but that only brings us one step nearer the unknowable, which we always come to sooner or later in any train of reasoning.

This brings to mind two examples given in a lecture forty years ago by Dr. J. F. Boynton. He said: "Why is the silver white and the gold yellow? Oh, that is easily explained. 'The silver reflects the white light and the gold the yellow.' Yes; but 'why does the one reflect the one and the other the other?' Again, 'What makes the watch go?' The mainspring, of course.' Oh, no; the untempered watch spring would not make it go; it's the temper. Oh, yes; but what is the temper?"

Mr. West, in his comments regarding the statements I made in regard to unequal contraction in duplicate castings, takes the ground that the irons being poor was why the castings did not shrink, while I take the ground that because the castings were prevented from shrinking the iron was drawn apart and made porous, and that the castings were prevented from shrinking by the tight fit on the core-bars. As these things repeated themselves day after day, and ceased when we used all small core-bars, it would seem that the weight of evidence was in favor of the explanation I gave.

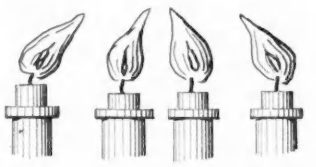
JOHN E. SWEET.

Smoke Stacks.

Editor American Machinist:

I have received from Charles H. Fitch, of New Haven, the following in reference to my contribution, June 19, on the above named subject. I think it will be of interest to others:

"Having read with profit many of your writings, it affords me pleasure to contribute a suggestion as to the matter of chimneys cited in the AMERICAN MACHINIST.



"You may have noticed how two candle flames placed near together will incline toward each other. With four or more it would be as in sketch.

"Draft is practically due to a couple or leverage, the body of light heated gas being on one side of the invisible fulcrum and the body of cool heavy air on the other. The tendency to rise will be strongest where the gas is hottest and over a battery of boilers in a row with furnaces all fired, the hottest point will be in the middle, the ends having each a "cool side" because constantly radiating away heat without return upon the outer side.

"The tendency to produce a draft by rising gas is then strongest in the middle, and just as soon as the central stack begins to fill with hot air its advantage increases just as though an increasing force were applied to a lever. The stacks at the sides may then be as high as the skies, but they are full of heavy air with nothing to displace it. Their height is unavailing because the draft must be started at the bottom before the top draft can be reached, and after it is started, as it must be over the hottest space offering an upward escape from the furnaces, the probability is that there would be a considerable down current through the side stacks diluting the gas ascending in the central stack.

"It might be that if only the side stacks were available, so powerful a draft could be obtained through their greater height, that when the central stack was uncovered its draft might be neutralized. It seems, however, in the case you cite that the side drafts once created were not strong enough to hold their own against the draft through the larger chimney over the hotter part of the furnace, and the advantage of leverage being once established the side stacks were again reduced to the condition of tall-tower cold air boxes.

"This explanation satisfies my mind, and I think it may be of interest to yours.

"ROBERT E. MASTERS."

An "Odd Lot."

BY S. W. GOODYEAR.

I presume that most of your readers have sometimes, probably many times, found among the "odd lots," the scraps and bits, odds and ends which accumulate in shops, many things which came quite handy. So, in matters of information relating to mechanical operations and methods, there is much of value in the "odd lots" of knowledge which lie around loose among practical men, and do not come to the notice of the average reader. That the AMERICAN MACHINIST, with its example so well followed by some other journals, has done the public a great benefit by inviting workers to state, in their own way, how many things are done, and why—as they understand the reason—must be apparent to all. In every issue, from the "odd lot" of some worker, or from many of them, are items of information which would have been sought in vain a few years since, at least, so far as finding them in print was concerned. Having chosen the above odd title, whether I shall be able to select from my "odd lot" any scraps of information either new or useful to your readers, remains to be seen. Among the articles I have read descriptive of methods for coiling spiral springs, I have noticed always an apparent recognition of the idea that an arbor, around which the spring was to be coiled, constituted an important, if not necessary part of the outfit. The most simple method of coiling spiral springs on an arbor is too well known to need description; but there are methods in which no arbors are used, and springs are made in which the use of an arbor inside, in the ordinary way, is precluded by lack of space for an arbor of sufficient size to stand the strain.

In a recent issue of the AMERICAN MACHINIST is a description of means for making long spiral springs, in which an arbor is to be used. Why not leave out the arbor, and make "wheels" (rolls) do the coiling without using three rolls instead of two? The principle is precisely that to be seen in use in the machine for forming stove-pipe, by which a flat sheet, or strip, corresponding to the straight wire for a spiral spring, is made to assume cylindrical shape, and by changing the relative distance of the three rolls from each other, a wide range of diameter can be made. For coiling spiral springs this principle is valuable, the diameter of coil and pitch being regulated by the distance and angle of the rolls; and, in the case of some conical springs, both double and single cones, machines are used which automatically increase or diminish the distance of rolls and resulting curvature of the wire as it is fed in, thus shaping the spring as accurately as though coiled on an arbor, and some of this class of machines cut the spring off when completed. This plan, however, as well as the arbor coiling plan, implies space within.

To coil spiral springs, long or short, without an arbor, there are needed a pair of rolls to feed the wire; a tube, or guide, extending from the rolls to a block of steel, or die, which has in it an open hole of the size to which the outer diameter of the spring is to be made; a hole of the size of the wire to pass through one side of this block, or die, and intersecting the chamber in the block—the die proper—at right angles, or at such other angle as the style of spring requires. This hole—through which the wire will be pushed into the die continuously by the feed rolls as it passes through the tube or guide referred to—must be just the diameter of the wire to be coiled above the bottom wall of the die, as it lies in a fixed position, with the axis of the hole constituting the die parallel, or approximately parallel with the axes of the feed rolls.

There is only left now to describe means for making the end of the wire, as it is pushed in by the feed rolls through the hole in the guide, and into and through the hole in the side of the die, which two holes make a continuous guide, and must fit the wire; take upon itself such angle, such spiral inclinations as are required to produce the desired pitch. Here is opportunity for much ingenuity, and the ringing of many changes on this simplest machine imaginable. The chamber may be spirally grooved to the desired pitch. The chamber may have fixed concentrically within its plain walls an arbor spirally grooved, or threaded, to fix the pitch, the grooves being of such depth as to admit the wire.

For close springs nothing is needed but a spiral wedge at the bottom of the die, the edge of the wedge beginning just where the end of the to-be-coiled wire commences to run against the back side of the chamber, and the base terminating just above the wire at the front of the die, the base of the wedge being no thicker than the diameter of the wire. This spiral wedge, I have called it, may be formed on the end of a piece fitting the back part of chamber or forming die, and held in position to close all that part of the chamber back of the entrance of the wire. With this last described arrangement, and feeding the wire in at right angles with the axis of the die, a spring of any length required may be coiled with an arbor. The spring thus made will be close. To make a close spring closer than close, that is, so that the respective coils each crowd against, and are crowded against by their neighbors in turn, to an extent which makes the initial resistance to extension much greater than in the case with a close spring coiled in the ordinary way, simply requires that the thickness of the wedge back of the entrance of the wire

be reduced, and that the wire be pushed into the die at angle inclined toward the wedge, the die being set at an angle to meet the requirement by being "slewed around," its open end from which the coiled spring is to emerge being thrown toward the line of axes of the feed rolls. In this way it will be seen that the wire may be curved with a slight angle of inclination, but be forced in assuming its position of spirality to a greater inclination, thus gaining great initial sustaining power.

Of course this principle is susceptible of being incorporated with machinery for cutting automatically to any length required. It is one of the cases where metal is made to go just where it is wanted, because it cannot get anywhere else. There are jobs attempted in which this is not the rule. For instance, bending a piece of iron at right angles, say to make a square band, and to preserve square full corners inside and outside. How many blacksmiths and amateurs have found this one of the most difficult of operations: Heating and upsetting before bending; upsetting after bending; a wasting away of material to lessen the size at each side of the bend, and a round corner resulting after all? And sometimes a little search in the scrap—the odd lot—of a smithy would disclose the fact that many failures have been made.

At the risk of wounding the sensibilities of those who sneer at the record of how "Jim Done It," in many of his successful operations, I will state how I saw Mike make a square corner. At the point where the square bend was wanted, he took a heat, and with his chisel cut perhaps three quarters through the bar of iron, and bent it at right angles. Now, selecting a piece of square iron of suitable size, he partly cut from it a piece a little longer than the gash described as having been cut in the other piece, and leaving it hanging to the bar for convenience in handling he took a "separate heat" on the pieces and welded the square piece into the gash in the outside corner. With it "stuck," the bar was removed by a turn of the wrist, or cut off with the chisel, and the ends of the welded-in-corner-piece projecting a little at each side, were hammered down even with the stock into which it was welded.

By the way, Jim said to me the other day as I stopped for a few minutes chat with him, while he was dressing over and hardening a diamond point lathe tool: "I made a thread tool a few days ago, from that steel, with which twenty-five steel screws $1\frac{5}{8}$" diameter, and $\frac{3}{4}$" long, 14 to the inch, were roughed out and cut to a finish without regrinding the tool." Said I: "Good steel. You don't heat very hot for hardening I see." Said Jim: "That's just the point. The steel that stands so well won't stand a high heat." I afterwards saw the designated threads at the end of twenty-five steel shafts and found them as Jim described. They were well cut and smooth, and the man who cut them showed me the tool as left by the job. It looked all right to cut as many more.

Among other things which have come into the "odd lot" of information to be found in your paper, is to be found a reference to "rolling friction," which puzzles me. As there is in the same paragraph a reference to "rubbing or sliding friction," to "power for resisting abrasion, and it is plain that the use of the term was made intentionally, and understandingly from this, which I quote: "It is now clear that any inference obtained from experiment rolling friction between metals, will not apply to sliding friction." I am led to ask. How does "the rolling of steel tires on steel rails" furnish the slightest ground for drawing an infernce that thereby a test of the "frictional resistance, or power of resisting abrasion" of steel has been made? In the rolling of a wheel on a plain surface there is no friction. If in the aggregate of wear on wheels and rails covering the time when there is a sliding friction, as well as when there is the continuously-changing-in-position-crushing-force at work, steel has been found better than iron, that is a point gained; but is not the term "rolling friction" a misnomer? When the wheels roll there is no friction. When they do not roll, but slide, there is "sliding friction," just as truly as between "cross-head and slide bar."

Core Oven with Rotating Back.

BY THOMAS WATHEY.

The sketches herewith represent the construction of a core oven, four feet diameter and six feet high—a size useful for small cores. Fig. 1 shows side view of oven, Fig. 2 a section; Fig. 3 is section and plan above shelves, and also through firing door above grate. Fig. 4 shows full shelf.

In the engravings, *a* is the shaft, which is made of $2\frac{1}{2}$-inch pipe; *b* shows the shelves, movable on shaft; *c* is cast-iron collar, on which shaft turns, the collars being secured by set screws. The bottom shelf *d* is cast solid between the circular ribs, with an opening around hub, the shaft resting on framing. The second shelf is shown at *e*; this is shown half turned over on the other half. The bottom framing is shown at *f*; an angle is shown cast around fire-box, on which the brickwork rests. The upper stop-frame is shown at *g*; this frame extends from front to back wall, and serves to keep the shaft in position. The round dumping grate is shown at *h*; this turns on a framing, bricked in the wall. The arm *j* is attached to slide, and is used to shake the grate, or to open hole in grate by being pulled out. The ash-pit door has a long slot, cast in the upper part of door frame; the grate frame moves in this slot. The arch *l* is to compel the smoke to pass up centrally.

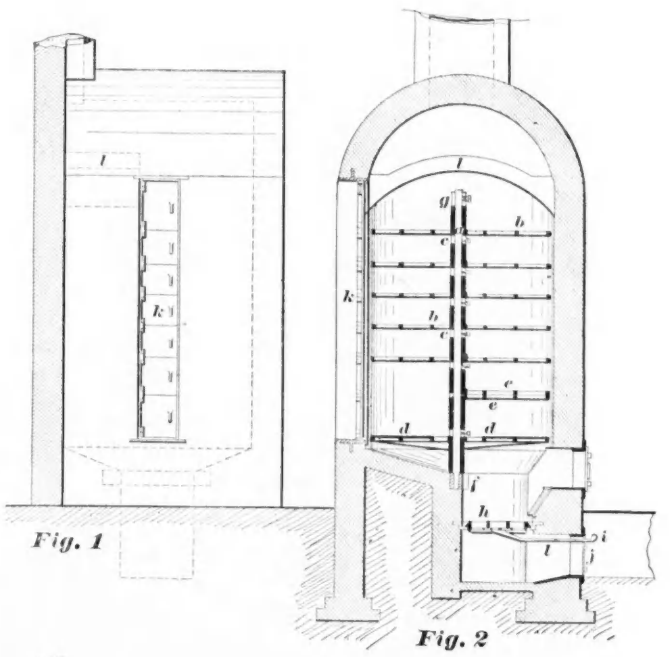


Fig. 1

Fig. 2

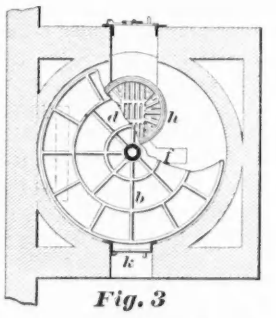


Fig. 3

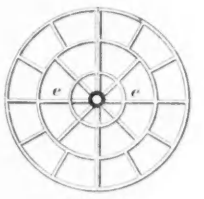


Fig. 4

CORE OVEN WITH ROTATING BACK.

The idea is to have an accessible oven with a series of small doors, thereby not losing much heat when putting in and pulling out cores. The number of doors is purely a matter of taste, as three may suit some, while others may want more. In the sketch seven doors are seen. It is a little more work to put them on at first, but in the end I think it is the most economical. It will hold a large number of cores, will use but little fuel, take up but little space (put it up in a corner), and by using hard coal or coke, it will require but little attention, and will run over night by using damper in chimney and drafts in doors. The bottom shelf, resting on solid framing, can be used for drying ladles, or (by laying over one-half of second shelf) for large cores; but for small ones it is unexcelled.

The shelves can be cast upon sand, with a sleeve under them, about five or six inches long (not shown in the drawing), as it will lessen the vibration as the shelves are being turned around.

Cable Railroad in Brooklyn.

A. H. Mathesius, whose system of cable road we have previously referred to, has obtained a franchise for a road from Wall Street Ferry, Brooklyn, to the top of the hill on Montague street. This covers private property belonging to Henry E. Pierpont. This is about one-third the distance from Wall Street Ferry to City Hall. A company has been organized to build a cable road on Mr. Mathesius' plans from Wall Street Ferry to City Hall, Brooklyn.

The manufacturer who wishes everything done as he would do it himself will be frequently disappointed in the men he hires. He will frequently change men in hope of finding just the man he wants, but the better way would be to employ the time lost in changing men by training one man gradually up to the work.

The machinist who can invariably make a fit with a certain pair of calipers to which he is accustomed is apt to be "completely at sea" when he is obliged to use a strange tool. There is a peculiar "feel" to the old tool which tells when the work is right.

The *Evening Post* of this city is in its natural element when it is telling workmen what they should not do. Recently, however, it departed from the even crankiness of its way to tell workmen what they should do. Then it made a mess of it. Among other things it advised workmen to "encourage employers to try the profit sharing and similar experiments." This is most preposterous. The only way to start the "encouraging" programme is to let employers know what they want. Imagine for a moment a delegation of workmen calling upon their employer and soberly asking him to divide a percentage of his profits among them. If he should not suddenly "encourage" them to get out of his office he would not rank as an average business man. We advise the *Post* to stick right to advising workmen what not to do (there is no danger of any of them following its advice), because when it gets to suggesting positive labor action there is danger that it will cause a revolt among its limited and select constituency of readers.

David Brooks was manager of a Pittsburgh railroad office, when a boy named Andrew Carnegie was a messenger in it at a salary of $3 a week. The boy had just arrived with his father and mother from Scotland, the land of his birth. That was a very little more than thirty-six years ago, yet to-day he is to day the famous millionaire ironmonger of Pittsburgh Andrew Carnegie has said: "I owe my rise in life to a game of checkers." I will explain to you what that remark means. The elder Carnegie was a moulder in a pottery. Like many Scotchmen, he was exceedingly fond of playing checkers. In Pittsburgh at that time was a well-known alehouse, in one room of which those who loved to play checkers were wont to assemble. Among them were Carnegie and Brooks, and in this way the two men beaame acquainted. Carnegie's son also came there at times with his father, and he, too, tested David Brooks' powers at draughts. One day the elder Carnegie remarked that he did not know what to do with his son. "Send him down to my office and I will make a messenger boy of him," said Mr. Brooks. The next day he began his new employment. The lad was intelligent and industrious. Manager Brooks had an old telegraph instrument fitted up in the office, and when the messenger-boys were not engaged he showed them on this how to tick out the Morse alphabet. With this instruction young Carnegie soon become a skillful operator. Thomas A. Scott was at that time Superintendent of the Pennsylvania Railroad in Pittsburgh. He had a telegraph instrument rigged up in his office and wanted some one to manipulate the key. Manager Brooks recommended young Carnegie, and he was employed. He showed such aptitude in managing the movement of trains by telegraph that he was transferred to the Superintendent's office in Altoona. There he continued to attract the attention of Thomas A. Scott, and was rapidly pushed along. He was given opportunities to engage in some coal and oil speculations that were successful, and afterwards made money from the first sleeping cars that were built.—*Philadelphia News.*

It is said the making of tin plate is to be tried again at Hubbard, Ohio. The black plates will be imported from Wales. With a proper tariff, the rolling of plates, as well as the tinning, could be done in this country.

The *Philadelphia Call* says: "The output of a Swiss watchmaker is forty watches a year; of a United States mechanic, 150, and the American earns in his skilled line of labor three times as much as his Swiss competitor."

The building of railroad cars and locomotives is a much better business than it was last year. Most car shops are well supplied with orders, and the demand for locomotives is twice as good as it was a year ago.

In our last week's issue we credited an item on liquid fuel burners to the *Sanitary World*, where we found it, supposing it to be original with them. We have since discovered that it was part of an editorial in the *Iron Age*, of April 22. If newspapers would always give proper credit when copying, we should never be led into such an error.

Experts expend a good deal of unnecessary time in attempting to show that steam users do not know the most economical fuel to use. As a matter of fact, steam users know a good deal more about this than experts do, and it may be depended upon that in any given locality they will be found using the fuel that costs the least money. What is wanted is to know how to make the most economical use of the available fuel in any particular locality. But this is something that figures alone will not show.

The principal streets of Chicago have been cleared of telegraph poles, and it is said that the various companies find that their wires work much better underground than overhead. In New York there has been a great deal of talk about putting wires underground, but no action.

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, JULY 24, 1886.

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Water Power Unreliable.

The unreliable character of water power in this country is making itself more apparent every year. When the power of a stream is utilized to anything near its ordinary capacity a shortage of water is liable to occur at any time and cause some of the wheels to stop turning, frequently inflicting serious loss upon the industries depending upon that power. In the older portion of this country most available water powers are utilized, and the usual charges for such power with all its fickleness are not enough lower than the cost of steam to warrant many new enterprises in adopting it. In the territories and newly settled parts of the country where water powers are but little utilized they will be cheap enough for years to come.

One of the most steady and reliable powers was supposed to be the falls of St. Anthony at Minneapolis. It has been mostly used by the flour mills of that city. Last winter the water become low and remained so for several weeks. Some of the mills were thus compelled to be idle, either wholly or part of the time, when the demand for flour was good. Those mills having steam engines took the benefit of the trade, while others suffered loss. Several of the Minneapolis mills have put in steam engines to use when the water runs low.

The power that always can be relied upon is that furnished by steam. When stoppages by drouths and freshets or by freezing are taken into account it will often be found that steam is also cheaper than water.

A contemporary notes that a large Troy stove manufactory is about to start branch works in Chicago because they are troubled with strikes at home. We have heard somewhere that Chicago had a few strikes since the snow melted away last spring. Perhaps, however, these were exceptional. Can it be that Chicago is the industrial Mecca where labor troubles have no place? We never would have thought it.

Cutting Down Railroad Shop Expenses.

We frequently hear railroad management commended for cutting down shop expenses by getting their work done with fewer men or by working short time. It seems to be taken without much question that this is an actual saving to the extent indicated by the pay roll, but there is ordinarily a good deal of delusion in such a conclusion. Commendation would oftener be to the point if it was because with the same amount of help, and full time, the rolling stock was kept in a better state of efficiency; or even that more help was employed to that end. In this as in most other matters, a thing is not cheap simply because it costs but little money.

This curtailing of shop expenses is seldom recommended, or believed to be for the best interests of the road, by the mechanical management. The edict goes out from those who know little or nothing of the needs of the case, and very commonly against the protests of those who do know. This course has a hundred times turned out disastrously, but it has an immediate effect on the financial showing. It may crowd up stock a point or two, which is frequently the chief end of railroad management. By and by, when accidents result from a general running down of machinery, they can be conveniently laid to Providential interposition, or some other equally reasonable agency. Or, when the general deterioration demands extraordinary expenditures, the need of economical financial showing may have passed; it may be desirable to show quite the contrary. The requirements of Wall street sometimes demand this.

The number of roads in connection with which master mechanics are allowed to keep what they consider a sufficient force to maintain their engines in the condition they would like to, is surprisingly small. Engines go on wasting steam enough to pay the wages of a shop full of men, because there is no time to take them in for repairs. It is not practicable to demonstrate this waste—at least it is not necessary to do so—while the cost of help in the shop is posted up and duly appears once a month.

When the high powers in railroad management get economically inclined—for immediate effect—the objective point is sure to be the shop. The ultimate consequence is very likely to be a hundred dollars lost for every ten dollars saved, but this does not count in view of the immediate effect. Parsimony in shop expenses not only compels master mechanics to use their engines in poor condition, but it also pretty effectually hinders them from carrying out anything of an experimental nature. They stick to old methods because they have no time to try new ones.

If you want a doctor to diagnose a disease, you equally require a carpenter to build a house. This conclusion is reached after a consideration of the fact that a committee without any qualifications to fit them for the business in hand has been at work for about two years to get the electric wires in New York under ground, without any practical results whatever. We suggest that a couple of practical mechanics be placed in this committee, and that three months be given them in which to do what the present committee has not done in two years. It is a great thing to plan "How not to do it."

A "Law and Order League."

According to recent dispatches to daily newspapers a "law and order league" is being organized throughout the country, "which can be largely massed if necessary at one point." In case of trouble too large for the league to cope with in one city they can call for reinforcements from other cities, "the members being bound to answer such a call." It is announced that the "principal object is to prevent labor disturbances and discountenance strikes and boycotts." Furthermore it is declared that "a committee of the league has been appointed to investigate all boycotts. Where the employer has given no cause for such extreme measures the league is to go to his assistance." It is said that the league has 17,000 members already, mostly in St. Louis and vicinity. As to what action this society can take to overcome a strike or boycott by lawful means we can not see. If what has been published regarding them is true a resort to force is anticipated. Where can "law and order" be found to sustain a private armed force that rushes from its own place of organization to some distant point to "discountenance" a strike? If a strike leads to rioting the kind of "law and order" upon which the institutions of this country are founded looks to a police or sheriff's force to restore the peace and take offenders into custody. If the force is not sufficient, special policemen and deputy sheriffs are, or should be, selected from the citizens, and no armed body outside should be invested with legal authority to act. If any armed organization is to be called upon to assist, the law provides that it shall be State troops under direction of the Governor.

The purposes of the "law and order league" may have been misrepresented in the press dispatches. We hope so. The very existence of such an organization, upon the plan outlined, is a menace to liberty and safety.

The Master Car Builders Association will hold its next annual convention, either at Minneapolis or St. Paul, the second Tuesday in June, and the Master Mechanics Association will hold its next annual convention, either at St. Paul or Minneapolis, the third Tuesday in June. Committees of each society are to decide at which city their respective conventions will be held. Probably one convention will be held in each city. The two cities are but ten miles apart (their corporate limits join), and as the people of each town are full of enterprise and push, there is jealous rivalry between them. As each city will try to outdo the other in entertaining the convention that meets there, members and visitors may expect to have a pleasant time. As June is not the month for the ice palace carnival at St. Paul or the big exposition at Minneapolis, special entertainments will be provided, especially such as will enable the visitors to comprehend the regular attractions of the twin cities.

We had a call one day last week from J. H. Barr, Department of Mechanical Engineering, University of Minnesota, of Minneapolis. The mechanical department has heretofore used a forge shop, wood-working shop and a vise shop. The last will give place to a fully equipped machine shop in a new building, 86×50 feet, with a wing for engine room, foundry, and blacksmith shop. Mr. Barr's trip to the East is for the purpose of purchasing tools. Eight or ten engine lathes will be placed in the shop at the outset; also a shaper, a milling machine, a drill press, two speed lathes, and other tools. The shop is expected to be ready for work in September. It is intended to have ten students working at a time in the machine shop.

Two men who have grown very wealthy by successful operations in syndicates, unions, and combinations of capitalists, recently hired the hall of Cooper Institute in this city for a "mass meeting" of workmen. They proposed to show workmen (at 50 cents a head admission) that labor unions never did any good and that it is a damage to belong to them. The principal owner of the Third Avenue Railroad bought a hundred tickets, and the meeting was well advertised and heralded by the press. When the meeting was opened there were just twenty men in the hall according to the report in the *Sun*, and the greatest number present at any time was ninety. Some of the audience were ready to argue with the speakers, and the fun was lively for an hour or two. Next time those two men of wealth want to urge workmen not to act together in unions they will probably hire space in some daily paper instead of lavishing their money for a big hall.

Literary Notes.

USEFUL HINTS AND INFORMATION FOR STEAM Users, with Rules for Engineers and Firemen, for the Management and Care of Steam Boilers. The J. N. Mill's Publishing Company, 30 Vesey street, New York City.

Some very good hints on the management of engines and boilers are given in this little book; also quite a number of useful tables. The tables do not all refer to steam, but cover such subjects as, weight of iron, wire gauges, etc. The price of the book is 25 cents.

The *Ladies' Home Journal* sends us a notice of their paper, which they would be pleased to have us use, "or a similar notice," in consideration for which they offer to "send the *Journal* regularly to the wives of your staff in reciprocation." The substance of the notice is that the paper is "a perfect gem, handsomely printed and illustrated; that it has over 200,000 circulation, which it has acquired inside of two years, and has a long list of Roses, Helens, Clarissas, Christines and other ladies of note writing for it". If our wives get the *Journal* this year, they will pay for it just the same as they do for other things.

STEAM-HEATING PROBLEMS; OR, QUESTIONS, Answers, and Descriptions Relating to Steam-Heating and Steam-Fitting, from the *Sanitary Engineer*. With one hundred and nine illustrations.

We look upon this book as a particularly valuable one in its line, because when questions are asked in this way many points are likely to be covered, information upon which is not readily found in available works. The questions answered are such as are likely to come up to men practically engaged in the business embraced in the title, and the answers have been prepared by men with extended experience in steam-heating and steam-fitting. The other matter has been judiciously selected with a view to making the work comprehensive in its character. We can confidently recommend this book to any one engaged in the kinds of work described, whether in putting up or designing, and to those having such plants in their charge.

The book is sold for $3.00, post paid, from the office of the *Sanitary Engineer*, 140 William street, New York.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(277) A. H., New Haven, Conn., writes: 1. I am running an engine which furnishes power for a large saw and planing mill. I have a brick chimney in which soot collects, and occasionally this takes fire at night and emits showers of sparks, endangering surrounding buildings. Would it be advisable to put a damper on top of chimney, to be closed at night? *A.*—We suppose one reason why you are troubled with the soot is that the chimney is considerably larger than actually needed for the purpose. As it is at night when you experience the trouble, we think your plan of a damper at top of chimney is the best that could be suggested. 2. Would you advise an engineer to purchase an indicator at the present high price, and do you consider it to be a paying investment? *A.*—This will depend upon what use he makes of it. We believe that an indicator ought always to be a part of the engine-room outfit. If his employer will not furnish one, we certainly think he should own one himself. But owning an indicator an engineer should make up his mind that to make it pay he will use it to assist him in studying steam engineering, and so advance his standing as an engineer. If he does this, we think there is no question about its being "a paying investment."

(278) S. R., Troy, N. Y., asks: Will an upright engine pound itself hot on the crank end if the brasses are loose? *A.*—Any engine with loose brasses is liable to "pound" hot. In the case of an upright engine the liability is greater than with a horizontal engine.

(279) L. P., Williamsburg, Ohio, writes: I have charge of an 8x18 plain slide valve engine, of old pattern, and have considerable trouble to get good joints on the steam chest, which is on top of cylinder, and has four ¾" bolts which pass through chest, with nuts on both top and bottom, which are all the means I have of clamping both joints. The joints have never been faced-off, and, of course, are uneven. The chest is 10"x12", and we run with 90 pounds pressure, per steam gauge. I have used rubber, but it will not last. Have also met with poor success when using asbestos cardboard. I formerly had no trouble, but they have put on more machinery until they have overloaded the engine. *A.*—Try lead packing. Make a pattern of ⅜" round iron to just lay around the steam chest where you wish the packing to come. Get the brass founder to cast some lead castings from this pattern, put one in each joint, and screw up. Longer bolts will probably be required for the chest covers. If ⅜" packing does not stop the leak try ½". The principal trouble is too few bolts to properly tighten the chest.

(280) A. B., Saginaw, Mich., writes: We want to harden castings during the process of pouring. They must not be too hard to finish. What we want is a close, hard iron, capable of resisting a good deal of friction, and which will take a smooth finish. We understand that a mixture of bismuth and flux, applied while pouring, will give the desired result, but we do not know how to apply it. Can you give us any light on the subject? *A.*—We referred this question to an experienced foundryman, who replies: "To alloy iron with bismuth will make the iron harder and closer grain. Antimony will produce the same result. One per cent. of antimony will render iron very close grain, susceptible of very high finish, and make a good wearing surface; but bismuth or antimony will render the metal very brittle, so brittle that it will break like ice, but in case of uniform pressure it would make a good surface for wear. Antimony can be inserted in the iron when in the ladle. Bismuth should be melted with the iron, then a great deal of the bismuth will volatalize. Bismuth can be inserted in the ladle, but antimony is cheapest. A very good article can be obtained by putting steel chips or turnings in the melted iron. The latter should be melted very hot. Why not use stove-plate scrap, or some No. 3 iron, or good mottled iron with charcoal (cold blast)? There is plenty of it in Michigan."

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

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Shafting Straighteners. J. H. Wells, Tampa, Fla.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st., N.Y.

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

20,000 addresses of steam users and users of machinery in 10 States for $10. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

C. L. Jackson & Co., successors to Jackson & Tyler, No. 54 German street, Baltimore, Md., machinery, tools and supplies, engines, etc. Lists and estimates furnished on application.

Wanted—Numbers 1, 2 and 4 of volume IV., 1881: must be in excellent condition for binding, if soiled we cannot use them; for copies described as above we will pay 25c. each, and prefer to have the whole three if possible. Parties favoring us will kindly write name and address on wrapper. AM. MACHINIST Publishing Co., 96 Fulton street, N. Y.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

Cain & Bro., Chester, Pa., will erect a carriage factory.

The Buffalo (N. Y.) Hammer Co. will erect shops to cost $15,000.

The Natural Gas Co., of Wheeling, W. Va., will build new machine shops.

Stern & Langerbeck will erect a 3-story factory at Eighth and Lock streets, Cincinnati, Ohio.

The Chicago & Great Western Railroad will build a $22,000 round-house in Chicago.

J. H. Jones, Talladega, Ala., will start a machine shop; also run a foundry.

D. R Klinger, Anniston, Ala., will build a carriage factory next fall.

Shirk & Bomberger, New Holland, Pa., will rebuild their machine shop recently burned.

W. C. Smith, Richmond, Va., contemplates building an extensive addition to his carriage factory.

John E. Burton, of Milwaukee, is building a large machine shop and foundry at Hurley, Wis.

The Straight Line Engine Co., of Syracuse, N. Y., have just put in a 11"x16" engine, to run electric lights of a new hotel near Fort Hamilton.

Scharzchild & Sulzberger will build three factories on First Avenue, between 45th and 46th sts., New York, to cost $55,000.

The Bridge Beach Mfg. Co., of St. Louis, will build a 15x79-foot iron foundry on Main street, between Poplar and Valentine streets.

The creditors of E. Remington & Son, Ilion, N. Y., are preparing to reorganize the company and start the works.

The Calera Charcoal and Furnace Co., Calera, Ala., has been organized with $100,000 capital, and will erect a blast furnace.

Hubbard, Bragg & Co., founders and machinists, Oakland, Me., contemplate important additions to their plant.

The Union Iron Works Co., Selma, Ala., will erect a new foundry and machine shop, each 40x100 feet, and pattern shop 30x40 feet.

Charles H. Jacobson, J. G. Diefenderfer and Charles C. Knauss, Bethlehem, Pa., will erect a large machine shop and foundry.

The Cockburn Barrow and Machine Co, has started a shop 60x75 feet on Eleventh Street, Jersey City, N. J. A force of 25 men will be employed.

The Pennsylvania Bolt and Nut Co., of Lebanon, Pa., will rebuild their works recently burned. The new works will be on a larger scale than before.

The Montgomery Iron Company, of Port Kennedy, Pa., formerly doing business under the same title, has been incorporated. Capital stock, $150,000.

The Jefferson Iron Works Company, Steubenville, Ohio, have given out the contract for the erection of a steel plant, to be completed by December 1.

The Penn Bridge Works, at Beaver Falls, Pa., are building a large addition to their extensive works. The have a large number of contracts on hand and are working overtime.

The employes of the Webb Manufacturing Company, in Chelsea, Mass., will establish a co-operative factory on the Rochdale plan, and have bought 20,000 feet of land for the purpose.

The McGowan Pump Co., of Cincinnati, have issued a new 60-page illustrated catalogue of steam pumps made by them. It embraces pumps for almost every purpose.

Lodge, Davis & Co., Cincinnati, Ohio, with plant and capacity of works increased one-third, are running full of orders on machine tools. They expect to put some new machinery on the market soon.

Scott, Donnell & Scott, Graham, N. C., previously reported as purchasing a site for manufacturing purposes, will soon begin erecting a cotton mill, it is stated.—*Baltimore Manufacturers' Record.*

J. S. Mundy, Newark, N. J., has just been building an addition to the machine-shop department of his hoisting machinery works, and has put in a number of new machine tools, with room for several more.

It is said that H. M. Morrison, one of the largest manufacturers of machinery in Glasgow, has decided to come to the United States and erect extensive works either in Pittsburgh or Philadelphia His specialty is machinery for hauling in mines.

A company has been organized at Sherman, Texas, with a capital of $50,000, for the purpose of building a large oil mill. The work of building the mill will be commenced at once, and will give employment to about 100 men.

Lawrence, Mass., has a company with a capital of $1,000,000, to manufacture an electric engine to propel street cars, the invention of C. A. Jackson, of Haverhill. The engine can be worked by a dynamo or battery, and the idea is to run it by storage batteries.

The capital stock of the Augusta Wrench Co., Augusta, Me., has been increased from $40,000 to $120,000, and Messrs. Frank Conant and S. R. Pingree added to the board of directors. The company has recently bought out two wrench concerns and consolidated with them.

The Pond Engineering Co., of St. Louis, have issued "A Brief Treatise on Water-Works," covering water-supply, quality of water, quantity of water, fire protection, water-work's systems and pumping machinery. Cuts and descriptions of Blake pumping machinery are given. The pamphlet is very neat and tasteful.

The firm of Boulton, Brown & Co., which is building the new steel works at Duquesne, twelve miles from Pittsburgh, Pa., on the Pittsburgh, Virginia & Charleston Railroad, has been merged into a company chartered under an act of 1874. The new concern will be called the Duquesne Steel Works. George Boulton is president, and C. H. Read general manager.

The Union Stone Co. have opened a New York office and warehouse at 36 John street. It is in charge of Geo. A. Walker, who has had much experience in the sale of emery-wheel machinery. They have a full line of emery, corundum and quartz wheels and machinery for mounting them, including a full line of polishing goods and nickel-platers' supplies.

The Warner & Hough Machine Co. have their new shops in St. Paul, Minn., nearly completed, and will be at work in them within a month. The machine shop is 100x50 feet, and the foundry 40x70 feet. They will build steam engines and special tools for machine shops. They have accepted the agency for Pedrick & Ayer's railroad repair shop tools, also for Harrington's hoists and elevators.

The Hartford Steam Boiler Inspection and Insurance Company promptly settled with the Troy Steel and Iron Company the loss by the boiler explosion at the Rensselaer rail mill June 7. The settlement included payments for the death of the three men fatally hurt, and for the wages lost by the other employes through the injuries they received. The settlement was at about $17,000.

William Z. Sener, George M. Franklin, and Chas. A. Fondersmith, three prominent business men of Lancaster, Pa., have purchased from D. B. Hostetter, assignee of the Lancaster Watch Company, the entire plant, building, etc., of that industry. They become sole owners of the factory, including the interest formerly possessed by Abraham Bitner. They will reorganize, and will add to the present large force employed at the factory.

The Connecticut river, and the streams that make it, furnish power to 2,298 mills. These take 118,026 horse-powers. The greatest number on any one stream are on Miller's river and its tributaries, 188, with 7,572 horse-powers; the second is the Chicopee river and its tributaries, 182 mills, with 14,904 horse-powers; and the Farmington is third, with 178 mills and 8,852 horse-powers. The greatest power, however, is taken from the Connecticut itself, whose main stream supplies 98 mills with 23,366 horse-powers.—*Boston Commercial Bulletin.*

S. W. Goodyear, of Waterbury, Conn., writes us: There are indications in our valley that manufacturing interests, which, by the way, have hardly felt a ripple of the great labor difficulties of the past few months, are expected to require increased room and facilities for further development. Here in our city the Holmes, Booth & Haydens Co., manufacturers of brass and bronze goods and silver-plated ware, are just completing extensive additions to their works. The American Pin Co. are also building a large addition to their already extensive factory. At Torrington, 20 miles above here, on the line of the Naugatuck R. R., the Coe Brass Co., are putting up a building, 250x175 feet in size, for increasing business.

The proprietors of the Belding Refrigerator Co. of Belding, Mich., have offered to establish a silk and spool factory at that place, providing the residents of Montcalm county will contribute $6,000 toward the enterprise. The firm operates silk and spool mills at Northampton, Mass., Rockville, Conn., and Montreal, Canada. The factory would give employment to 300 hands. Henry Leonard and Spencer Bros., prominent merchants of that place, are taking active steps to raise the money. All the other residents are anxious to get the factory there.

The *American Manufactuarer*, of Pittsburgh, says: "A company, with a capital stock of $60,000, to be known as the Pittsburgh Iron Car Works, is being formed in this city. Prospectuses have been sent out to business men, and it is claimed nearly half of the capital stock has been subscribed. The company will manufacture iron cars, such as are now used at the Lucy Furnace, and forge and structural work in general. Jos. H. Gartside, of this city, is at the head of this movement. He is confident of success, and expects to have a mill in operation inside of a year.

The directors of the Roane Iron Works, Chattanooga, Tenn., have decided to convert the works into a steel plant, and manufacture by the Bessemer process. More than $1,000,000 of capital is invested in the works, which have been idle nearly two years, A four-ton converter will be put in immediately. Another will soon be added, and arrangements will be perfected to put the plant in operation Dec. 1. The recent successful effort at the South Tredegar Iron Works to manufacture steel from the celebrated Cranberry ore obtained at Roane Mountain, North Carolina, has effected this change. It is now ascertained that the ore is readily convertible, and the steel made therefrom is of an excellent grade. The plant will commence with the manufacture of steel rails, and arrangements will be completed to convert 150 tons of iron ore per day. When in operation the works will give employment to 1,000 men.

"There never was so brisk an inquiry for cars as at present," says Mr. Matthews, the contracting agent of the Pullman Company, in New York. "There is hardly a road in the country that is not in the market, and for all sorts of cars." The list which Mr. Matthews had of the cars to be built within the next two months comprised every variety, from a street car for an electric railway in Appleton, Wis., to a sleeping car for the New York Central. The order for the Central will not be entirely filled till the close of the year. It is for 49 sleeping and drawing-room cars, and is the largest ever placed by the company. The St. Paul is to receive some new sleepers, and new passenger equipments will be delivered within six weeks to the Atchison and the Northwestern from these shops. A lot of horse cars go to the Minneapolis Company, and a small lot to Helena, Montana, which has just got a new horse railway from the town to the railway station. The orders for box cars will keep the shops busy until the close of the year. Prices are about 5 per cent. lower than last year, and lower than ever before.—*Railway Review.*

The two engines that drive the Brooklyn Bridge cable are 250 horse-power each. They were built by the Dickson Mfg. Co., and work entirely satisfactory. But the increasing bridge travel requires more power, and bids were recently opened to furnish two 600 horse-power engines for that purpose. The following bids for the engine were received:

William Wright, Newburgh, N. Y.	$14,910
Dickson Mfg. Co., Scranton, Pa	18,150
Phenix Iron Co., Trenton, N. J.	17,350
Hewes & Phillips' Iron Works, Newark, N. J.	17,500
Southwark Foundry and Machine Co., Philadelphia, Pa	18,150
Buckeye Engine Co., Salem, Ohio	19,000
Fishkill Landing Machine Co., Fishkill-on-Hudson, N. Y	21,300

For the remainder of the plant, including cable drums, sheave pulleys, etc., the bids were:

Southwark Foundry and Machine Co., Philadelphia, Pa	$17,836
Phenix Iron Co., Trenton, N. J.	26,390
Poole & Hunt, Baltimore, Md.	27,815
Dickson Mfg. Co., Scranton, Pa	28,110

In each instance the lowest bid was accepted, the awards being made to William Wright for engines, and the Southwark Foundry for the cable plant.

A monstrous dynamo is now being manufactured for the Cowles Company, of Lockport, by the Brush Electric Company, of Cleveland. It is four times the size of any dynamo ever before constructed, and an engine of 500 horse-power will be required to operate it. It will be of sufficient power to light with incandescent electric lights a street from Cleveland to Cincinnati. This wonderful dynamo is shunt wound, with eight large field magnets, and weighs 20,000 pounds. The hub is made of the Cowles aluminum brass instead of German silver. The cables used to carry the current of electricity are composed of sixty strands of copper wire, each strand being about the size of a lead-pencil. The Brush Company will construct two additional machines of the same capacity, and it is expected to utilize all three in one shaft or cupola electrical furnace. The dynamos will be put in the Cowles works, which are now very nearly completed. The process of electric smelting will be conducted there continuously, and very much after the fashion of an ordinary blast furnace. The electricity will be shot into the bottom of the furnace in the same way that the hot-air blast is pumped into an upright furnace. The company is far behind in its orders. Aluminum is now being added to all common metals, iron and steel, as well as brass, copper and bronze.—*Industrial World.*

Machinists' Supplies and Iron.

NEW YORK, July 8, 1886.

One of the hopeful signs of future business prosperity is seen in the iron business of the country. Notwithstanding more furnaces have been blown in, the demand is well up to the supply, and little or no stock is accumulating. In general machinery and supply business prospects for a fair fall trade are good.

Iron—Prices for American Pig continue: No. 1 X Foundry, $18 to $18.50; No. 2, $17 to $17.50; Grey Forge, $16 to $16.50.

Scotch Pig—Sellers are holding prices firm against small demands. We quote Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.50; Eglinton $17.50 to $18; Langloan, $19.50, and Dalmellington, $18.50.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—A man that is a good machinist, and understands building wire nail machines. Address Wire Nail, AM. MACHINIST.

Wanted—A good draftsman on wood-working machinery; state experience and salary. P. O. Box 3306, New York City.

Salesman—Situation wanted; experienced in iron and wood-working machinery, steam engines and general supplies; large experience; first-class references. Address E. W., AM. MACHINIST.

Die-Maker Wanted—A good, sober and competent die-maker, familiar with sheet-metal-working machinery and tools, can secure permanent situation in fine, healthful town in Ohio: 10,000 inhabitants; excellent schools; cost of living, low. Address, with references, stating experience and wages desired, Lock Box 337, Fremont, Ohio.

Wanted—Foreman for printers' machine shop; a man capable to superintend repairs of all kinds on presses, cutters, etc.; also general jobbing and constructing; one with some cash can have interest; business has been established several years; has good run of trade; modern tools in shop, and experienced men only employed; references required. Address "Printers' Machinist," AM. MACHINIST.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co. Cleveland, O.

Steel stamps, stencils, burning brands, and brass checks. T. M. Parker, Hartford, Conn.

Light machinery of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Send for estimates of high-speed compound engines for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E.D., N.Y.

Engine lathe castings for 20"x8½', and drawings, first-class; $40. Shied & Snyder, Williamsport, Pa.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Best method of face and figure drawing; just the thing for every draftsman; send 50 cents for chart giving correct proportions, with diagrams. Wm. A. Emerson, Fitchburg, Mass.

Wanted Immediately—A first-class machinist, with some capital, to take half interest in machine business; also cider and jelly factory. Address at once for particulars E. F. Kelly, Caro, Tuscola, Co., Mich.

For Sale—10×20 horizontal engine, cut-off valves, heater, pump, etc., complete; this engine has been in use 3 months, and is a finely built engine; made by Whitehill, of Newburgh, N. Y., and for sale cheap. Shultis & Co., Kingston, N. Y.

M. Martin, manufacturer, P. O. Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

Wanted—A practical machinist, with some capital, to take partnership and entire charge of a machine shop equipped with new tools; a foundry doing a large business will be run in conjunction with same. Murray & Stevenson, Anniston, Ala.

Wanted—A first-class man, with strictly temperate habits, to buy ⅓ or ½ interest in sash, door, blind and furniture factory; well equipped; desirably located between two trunk line railroads; fine opportunity for the right man to take charge of and run the business; all new machinery; entire plant and grounds worth $12,000. Address T. M. Draper, Oxford, Ala.

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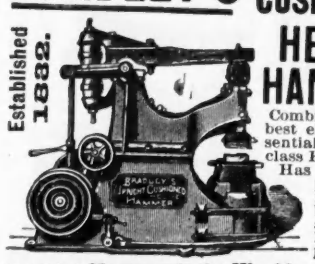

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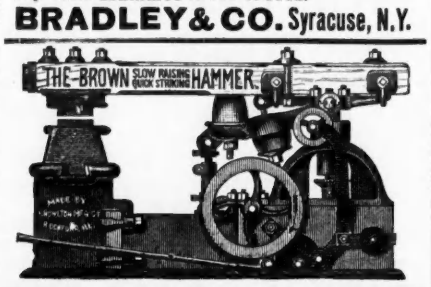

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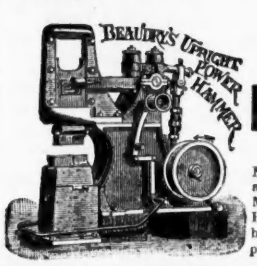

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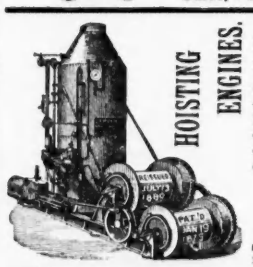

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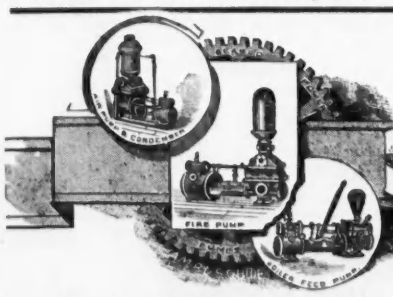

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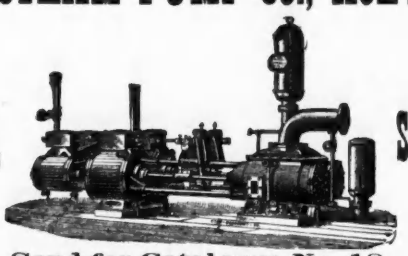

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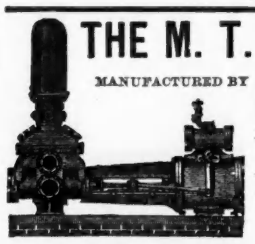

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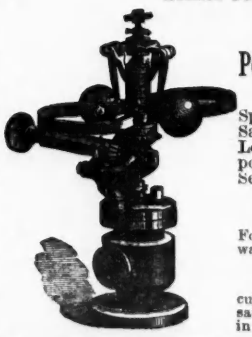

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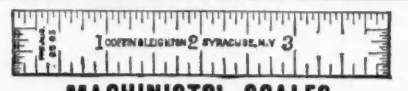

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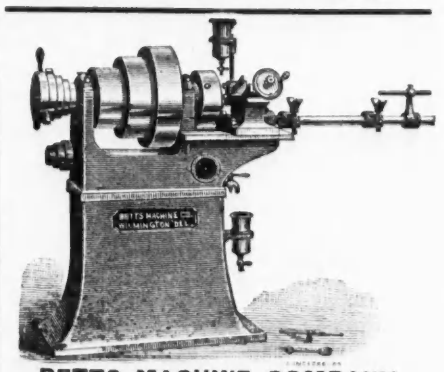

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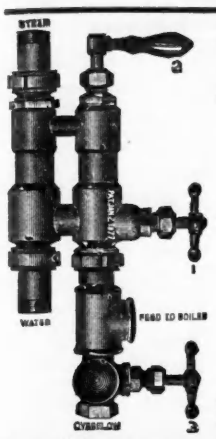

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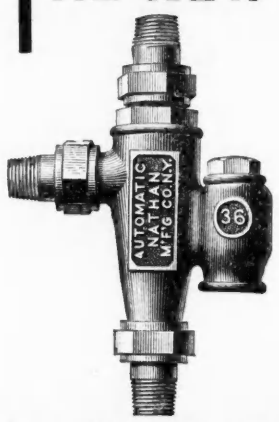

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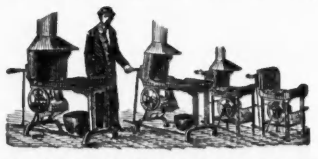

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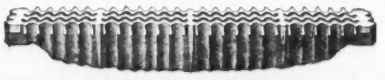

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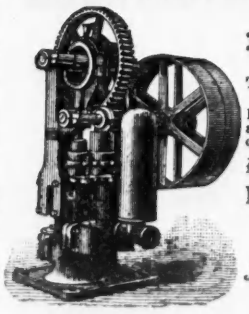

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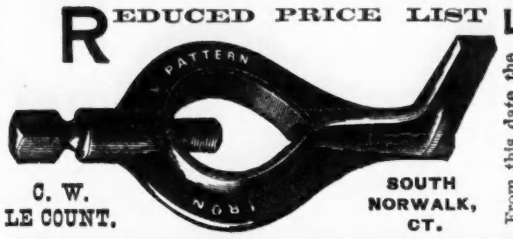

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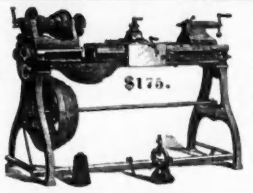

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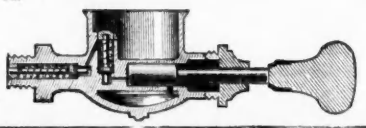

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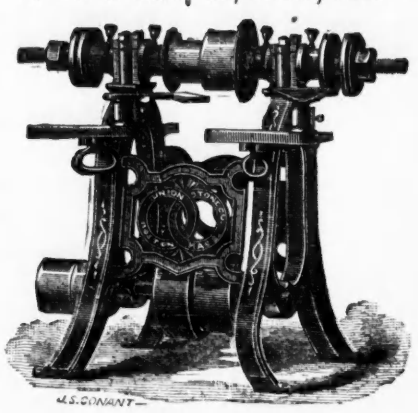

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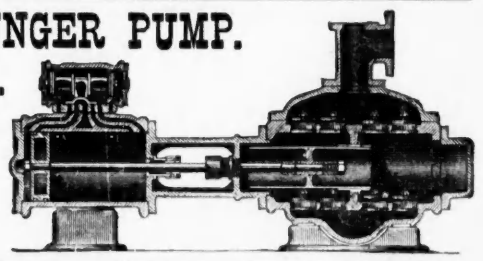

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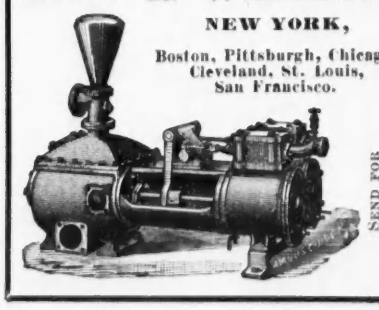

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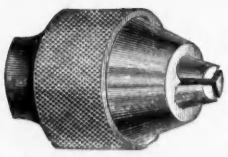

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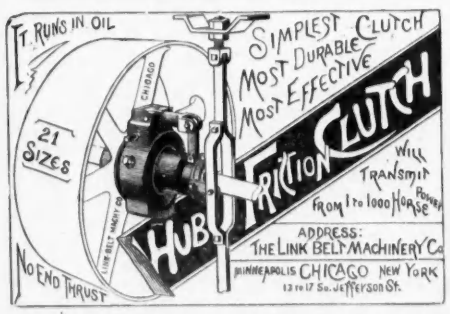

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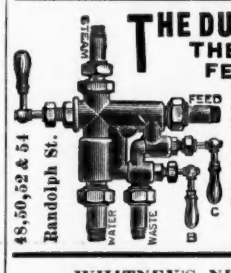

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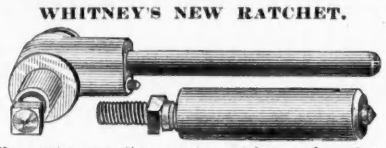

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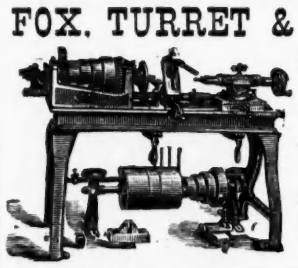

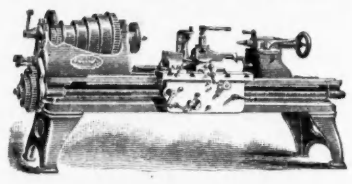

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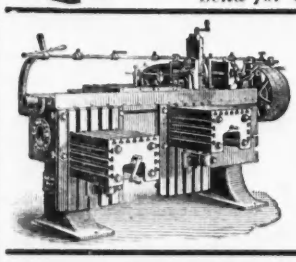

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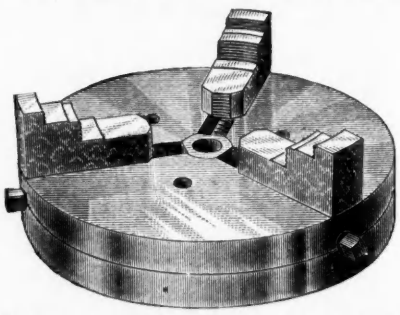

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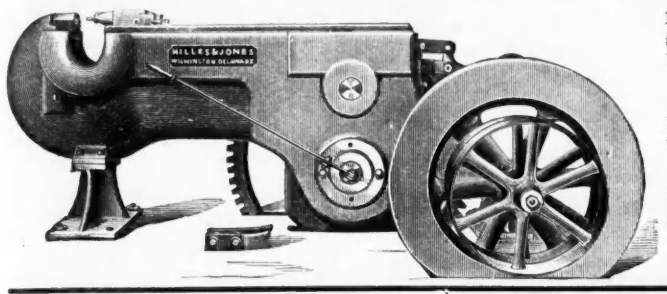

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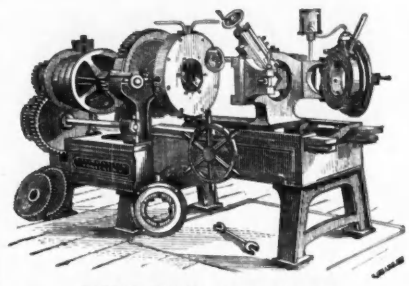

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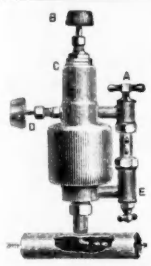

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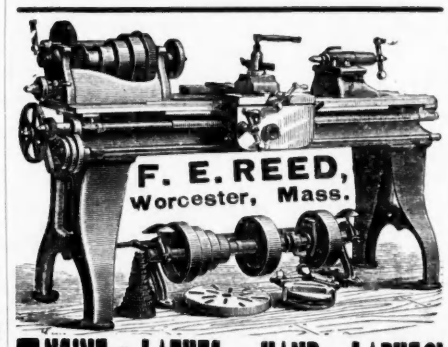

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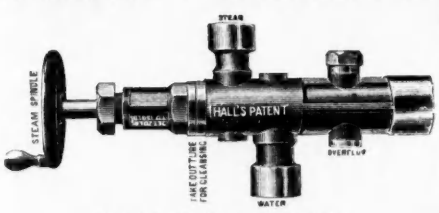

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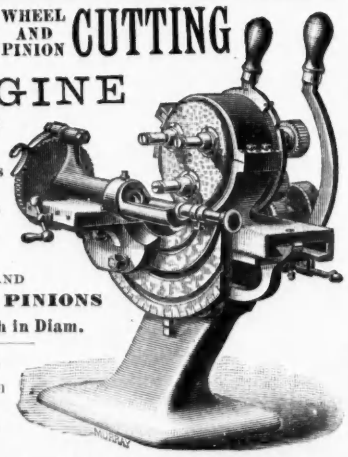

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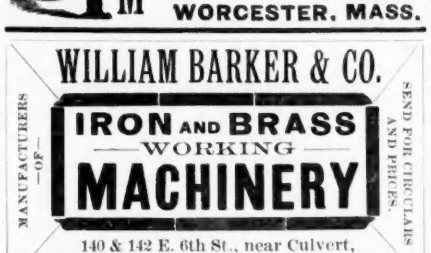

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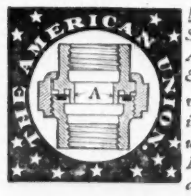

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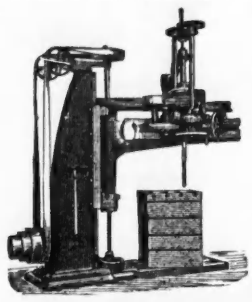

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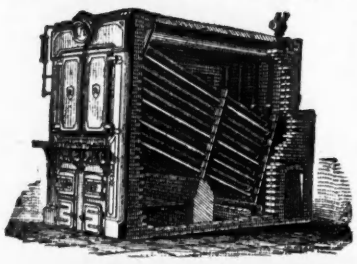

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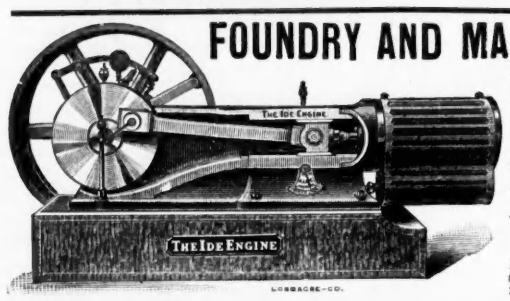

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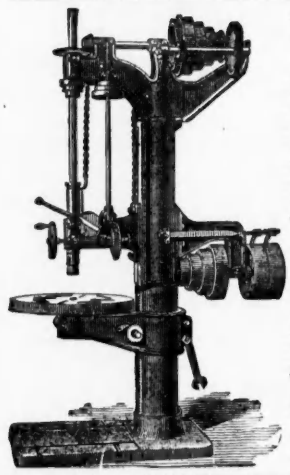

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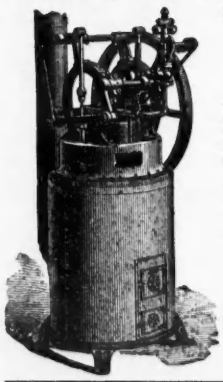

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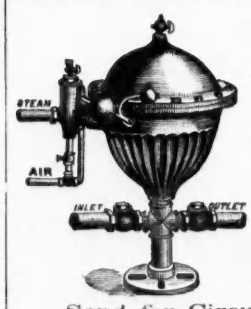

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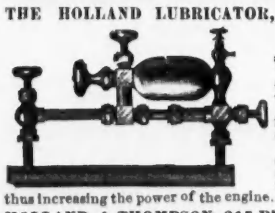

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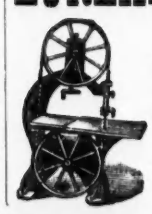

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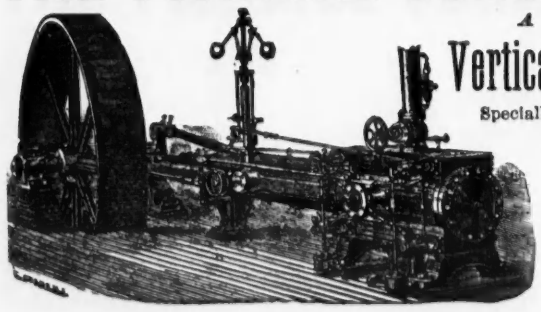

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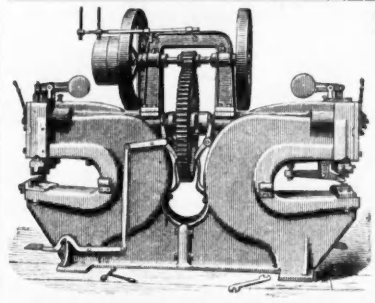

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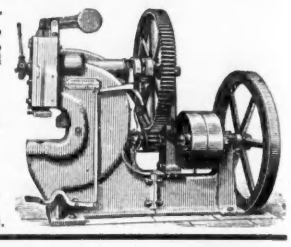

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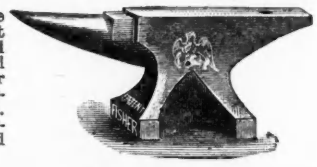

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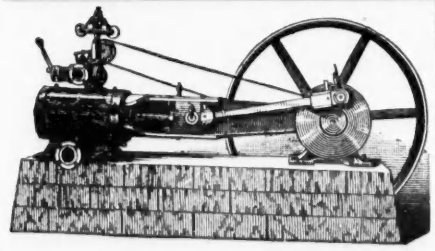

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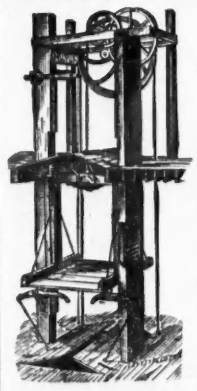

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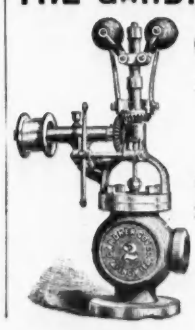

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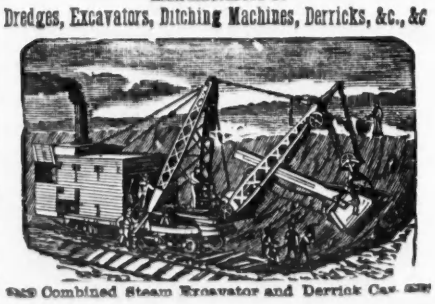

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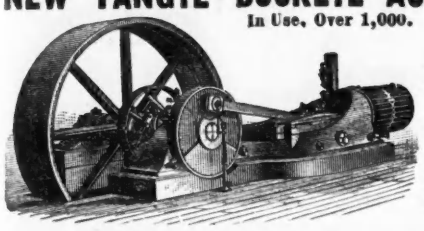

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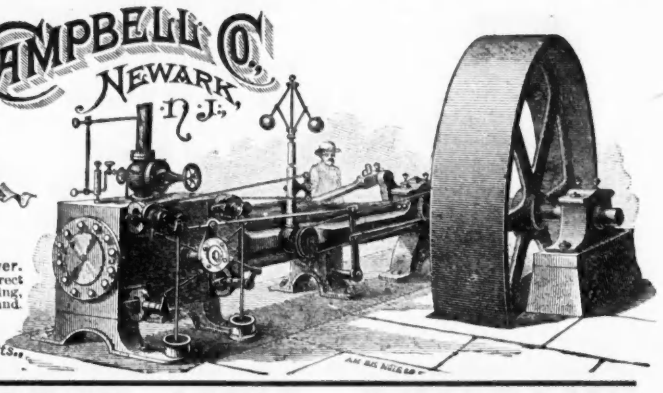

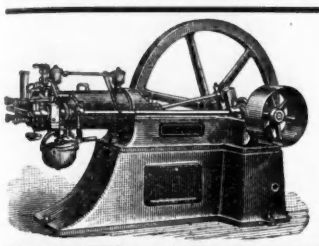

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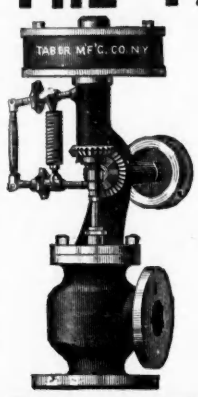

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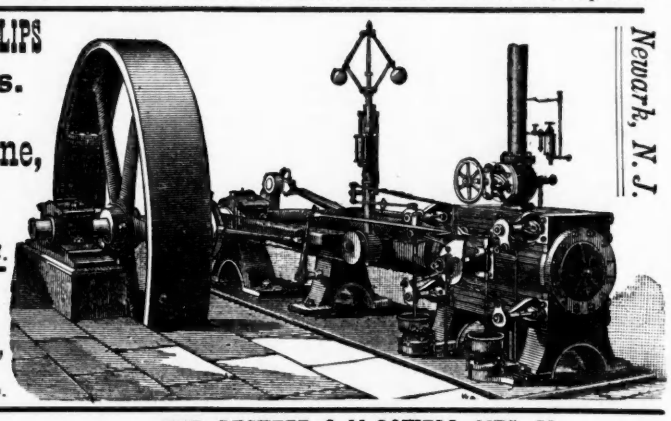

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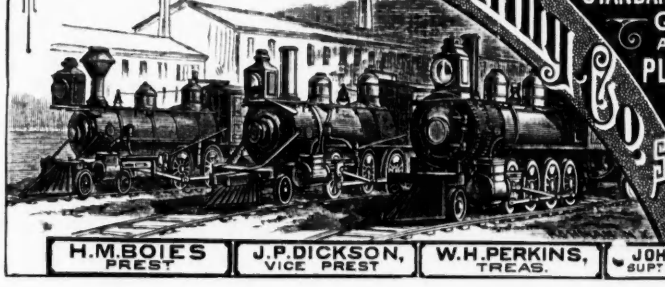

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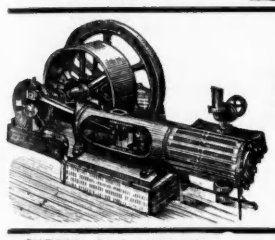

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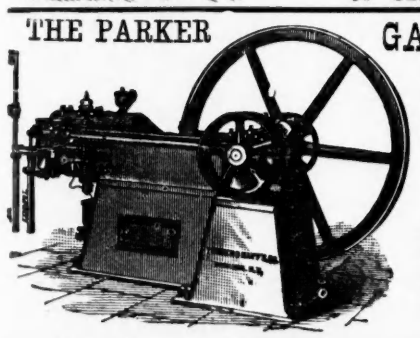

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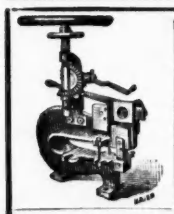

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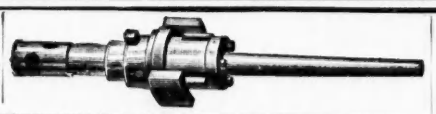

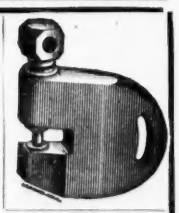

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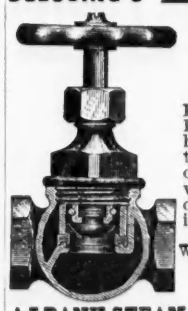

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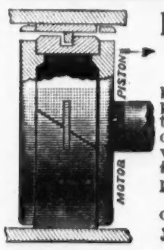

By its use a piston is self-packed against pressure, this pressure being balanced so as to permit neither the forcing of the rings *outwardly*, causing wear of rings and cylinder, nor *inwardly*, allowing the fluid to pass by them.

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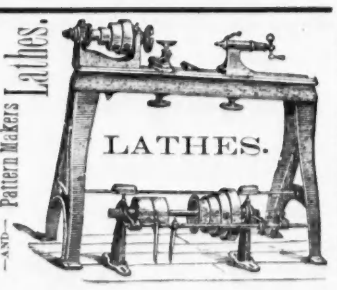

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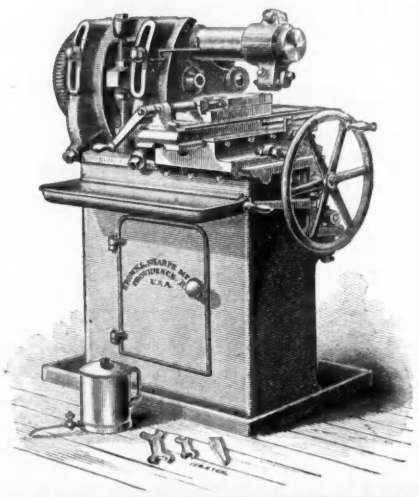

We have in our works and in constant use, about one hundred Milling Machines, and our experience with them has demonstrated that for manufacturing purposes where many duplicate pieces are required, that the best work is produced and the most economical results obtained from machines that are compact and solid, so arranged that the pieces operated upon can be quickly placed in position and quickly removed after the cut is taken.

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The Feed is automatic with three changes, stopping automatically at any required point.

The Vise has jaws 6⅛″ long, 1 7-16″ deep, and will open 3⅜″.

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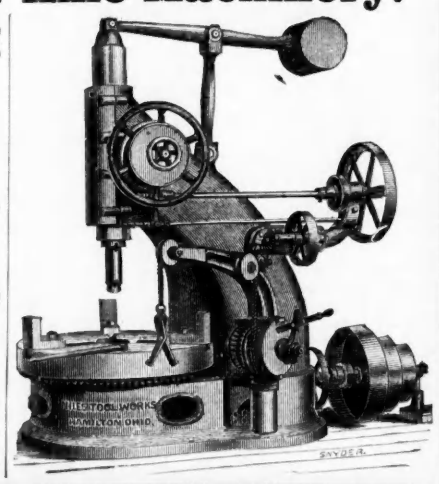

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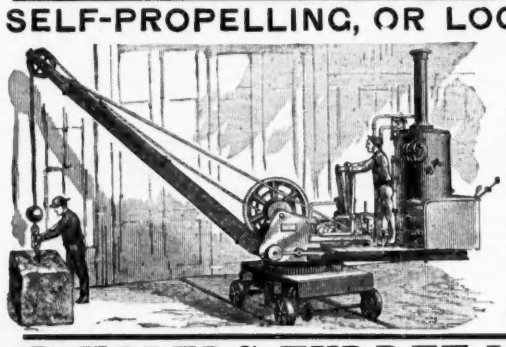

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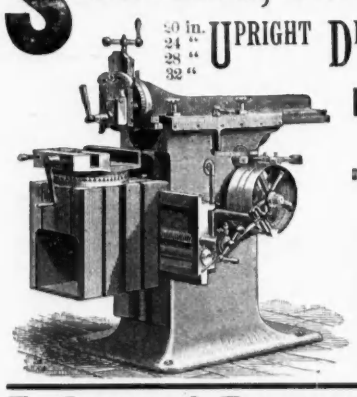

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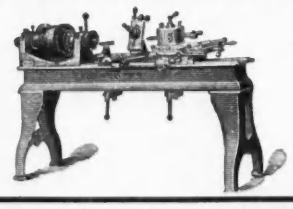

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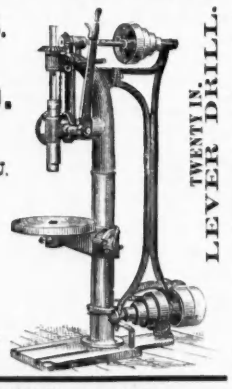

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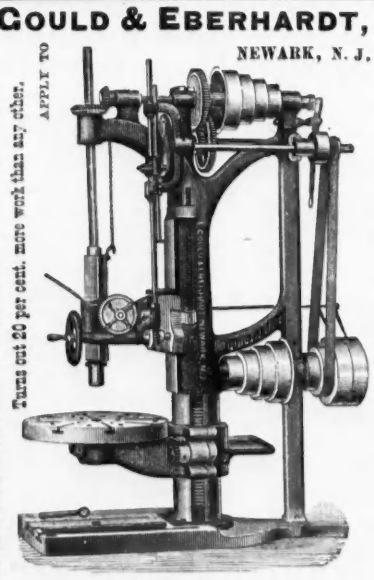

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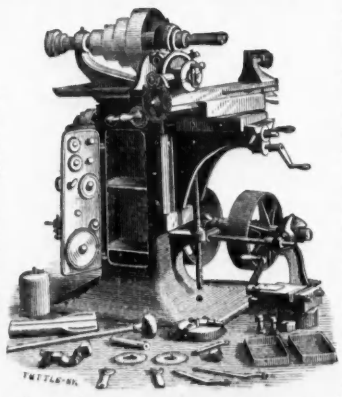

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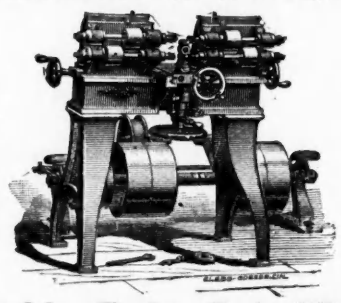

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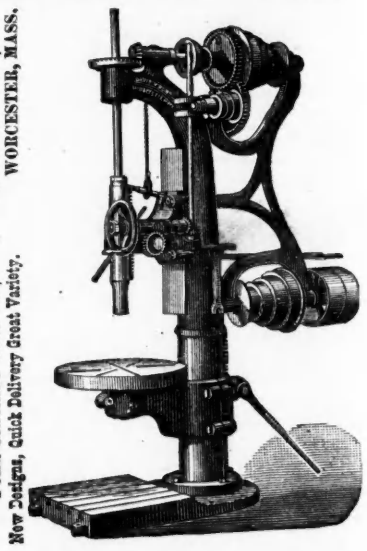

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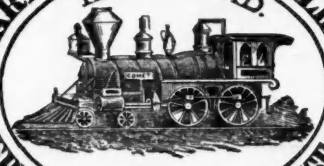

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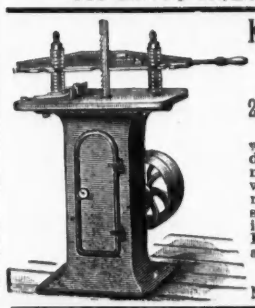

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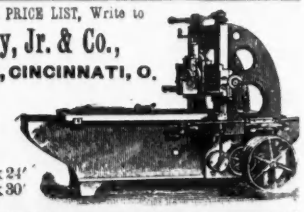

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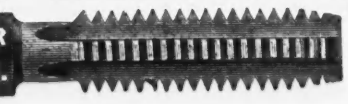

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